The FOUNDRY

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Will Make Castings at Sea

New Vessel Has Modern Equipment for Making Much of the Major Repair Work Needed by the Fleet—Two Cupolas and Four Tilting Crucible Furnaces Used—Pattern Shop Also Provided

BY LIEUT. COMMANDER A. M. CHARLTON

FOUNDRY equipment on battleships, airplane carriers and tenders of the navy were described in THE FOUNDRY, Aug. 1, page 584. The tenders, as their name implies, are mother ships for the various vessels named and are able to care for most of the wants in the repair line. However, another class of vessels is provided for each fleet to care for the work beyond the capacity of the tenders and for major repairs on capital ships. These vessels are called repair ships and at present one is assigned to the fleet on each coast. These vessels combine as

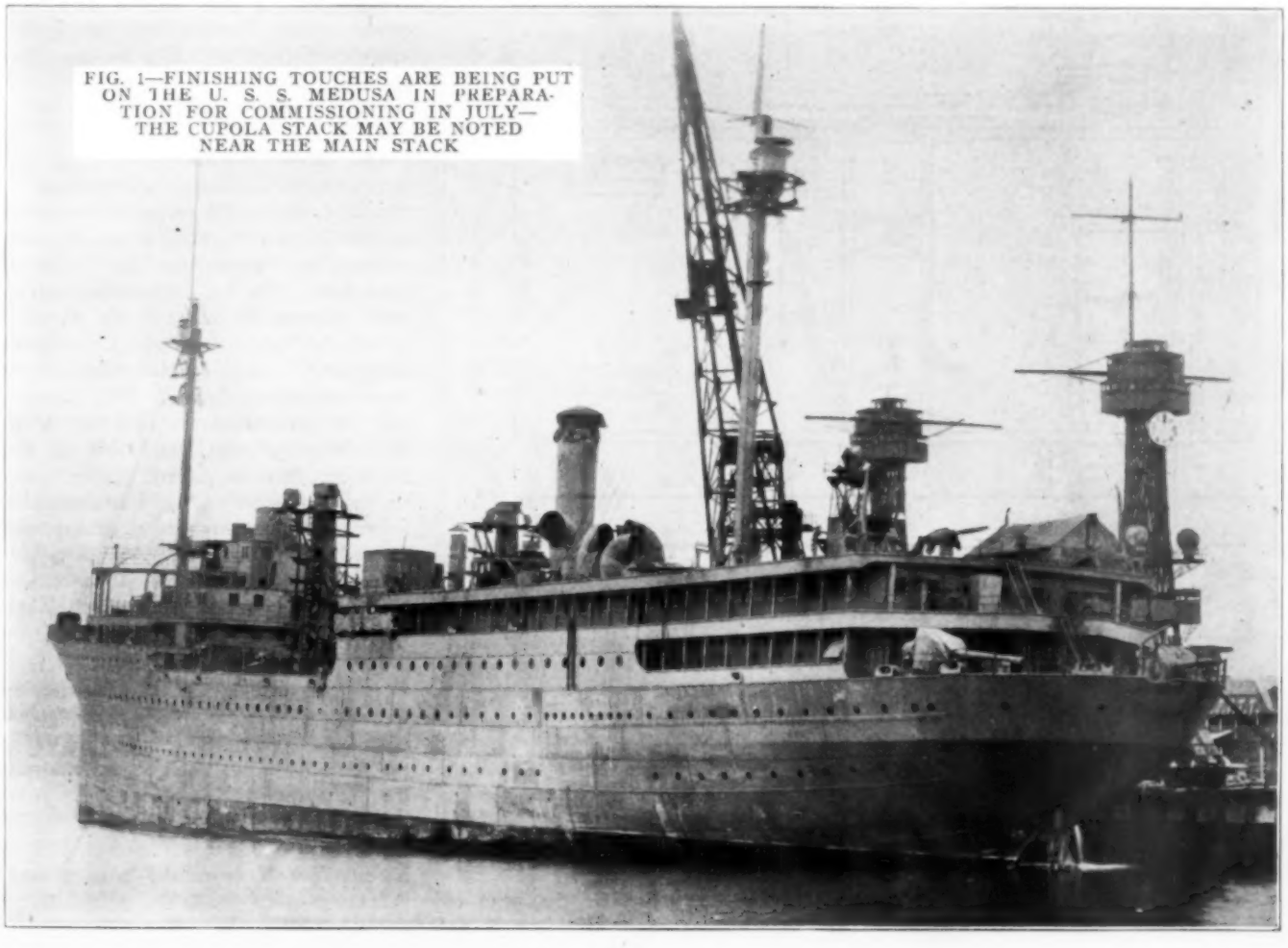

FIG. 1—FINISHING TOUCHES ARE BEING PUT ON THE U. S. S. MEDUSA IN PREPARATION FOR COMMISSIONING IN JULY—THE CUPOLA STACK MAY BE NOTED NEAR THE MAIN STACK

far as possible the repair facilities of a navy yard with the ability to move from one place to another with the fleet.

Until the present year, the navy has had no vessels designed and built as a repair ship. The two in commission, the VESTAL and the PROMETHEUS, were built for colliers and later converted to repair ships. Their equipment was influenced by the fact that they were not originally designed for repair ships and thus lacked some features desirable in that class of vessel. A description of the PROMETHEUS was published in THE FOUNDRY in Jan. 1, 1921, page 23.

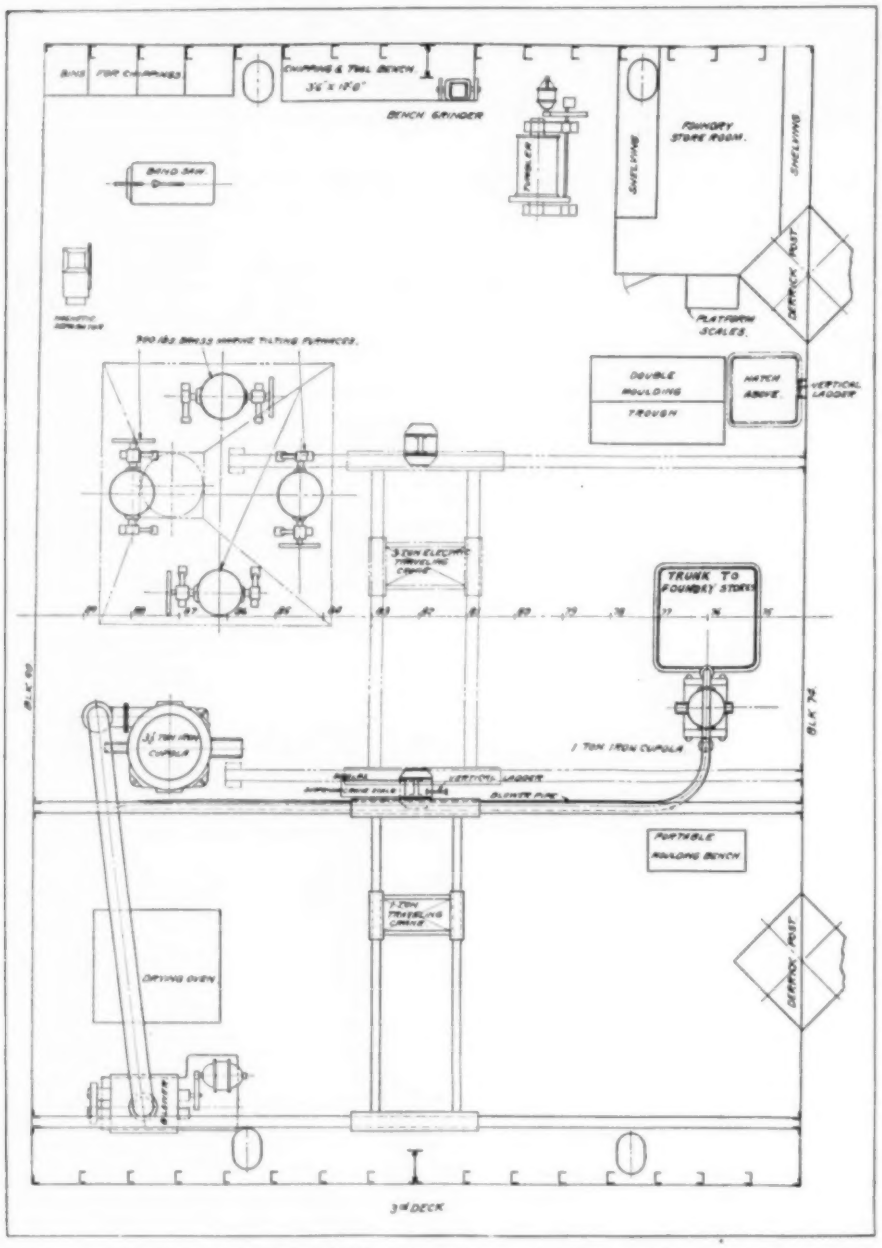

FIG. 2—ARRANGEMENT OF EQUIPMENT ON THE MAIN FLOOR OF THE FOUNDRY—SUPPLIES ARE KEPT BELOW THIS DECK AND BROUGHT UP BY A CRANE THROUGH THE HATCH SHOWN AT THE RIGHT

The MEDUSA, which was commissioned in July, was authorized as a repair ship by congress, her keel being laid on Jan. 2, 1920 at the navy yard, Puget Sound, Wash. She is 483 feet 10⅛ inches long overall, has a beam of 70 feet and at her normal displacement of 10,000 tons has a draft of 18 feet 11¾ inches. She is a single screw vessel with a geared turbine made by the W. & A. Fletcher Co., Hoboken, N. J., and two oil burning boilers built by John I. Thornycroft & Co., Ltd., London, England, each with a heating surface of 7000 square feet. Her estimated, full-power speed is 16 knots and when making this speed she develops 7000 shaft horsepower. To furnish lighting and power for the many activities of the vessel, four 125 volt direct current turbogenerators are installed with a total output of 800 kilowatts. The complement of the vessel includes 24 officers and 434 enlisted men. Of the latter 160 are assigned as the repair force, in distinction from those who operate and repair the propelling machinery and auxiliaries of the ship. The repair force includes men of the following rates: Special mechanics, electricians, carpenters' mates, patternmakers, boilermakers, blacksmiths, molders, coppersmiths, painters and firemen. The latter serve as helpers. Twelve of the repair force are molders.

The repair shops include the following: Pipe shop, plating shop, sheet metal shop, optical shop, gyroscope repair shop, gyros being used in torpedoes and compasses, paint shop, blacksmith shop, boilermaker's shop, machine shop, sailmaker's shop, pattern shop, and foundry.

It would doubtless be of interest to the readers of THE FOUNDRY to have a complete description of this floating repair shop, but the writer will confine helpers. Twelve of the repair force are molders.

The foundry of the MEDUSA covers a floor space 48 feet in a fore and aft direction and extends the full width of the ship, nearly 70 feet. It is two decks or about 20 feet high. The whole of the lower deck is used, while the upper deck is arranged as a gallery, extending around three sides. The total floor space available is thus nearly 5000 square feet. Besides these spaces a large storeroom is located two decks below and directly under the foundry to which access is had through a trunk 6 feet square. Figs. 2 and 3 show the floor plans of the foundry.

The melting equipment consists of a 3½ and a 1-ton cupola, and four 700 pound, brass, marine, oil-burning, tilting, crucible furnaces, all located on the third deck. The cupolas were built by the Whiting Corp., Harvey, Ill. Both cupolas are installed on the lower or third deck. The 3½-ton cupolas with its stack is some 60 feet high as the stack is brought high enough above the upper deck for the gases to blow clear of the personnel on the topside. The charging door for this cupola is 12½ feet above the bottom of the foundations so that the upper deck or gallery of the foundry may be used as a charging platform. The cupola and stack are well secured with holding down bolts and guys so that when the ship meets with heavy weather the cupola and stack will not get adrift.

The 1-ton cupola is mounted on trunnions and has no air chamber, the air from the blast pipes entering through the trunnions. There is no charging door, the cupola being charged at the top. The diameter of the shell is 27 inches and the overall height is 10 feet. The cupola may be turned to a horizontal position for cleaning and relining when necessary. No stack is provided, the gases escaping through the hatches in

the main deck of the vessel, under which this cupola is placed.

The brass melting furnaces were built by the Monarch Engineering & Mfg. Co., Baltimore. They are grouped together on the third deck with a hood provided for collecting the gases. This hood in turn has an outlet into a stack which discharges above the decks. The stacks for the cupola and for the brass furnaces may be seen in Fig. 1 near the main stack.

Air for the cupolas and the brass furnaces is supplied by a low pressure blower made by the P. H. & F. M. Roots Co., Connersville, Ind., which delivers 3200 cubic feet of free air per minute against a pressure of 16 ounces. The blower is driven through gearing by a constant speed specially designed motor, built and installed by the General Electric Co., Schenectady, N. Y. Blower and motor are on the same cast iron foundation. This blower supplies air to the two cupolas and to the four brass furnaces, the air ducts being fitted with dampers to close off the discharge to apparatus not in use.

Electric Oven Heating

On this same deck is a mold drying oven, 7 x 7 feet 10 inches x 7 feet 6 inches high. It was built by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and is suitable for temperatures up to 450 degrees Fahr. It is made of galvanized sheet iron lined with 4 inches of insulating material, which is in turn covered with galvanized sheet iron. Double doors are provided on the long side. On each side of the oven are five heaters made of nichrome wire wound on fire clay insulators. Each heater takes 2.5 kilowatts, so that the power input in the oven is 25 kilowatts. The heaters are of the open-core type with a space between the side wall and the protecting screen giving rapid circulation of air. Rails and a truck are used for handling molds into and out of the oven. On top of the oven a 1/6 horsepower, motor-driven blower is mounted for exhausting fumes and gases from the oven. The electric equipment supplied includes a control panel with magnetic contactors and a motor operated snap switch, an electric contact control thermostat, a graphic recording thermometer, a push button switch and a door cut-out switch. This equipment allows the temperature desired to be maintained constantly. A 30 x 36-inch tumbling mill made by the Whiting Corp. is installed for cleaning the castings. This is driven by an electric motor, the tumbler being geared down to the proper speed.

The equipment for separating and stowing scrap metal and chippings is located in the port after corner of the third deck. A magnetic separator with a capacity of 500 pounds per hour, and an 18-inch metal band saw are installed near the scrap metal bins. A chipping and tool bench on which is mounted a 2 x 16-inch double bench grinder, motor driven also is provided. A foundry storeroom on this deck provides storage for small foundry tools and stores kept there for issue. A 2000-pound platform scale, a double molding trough, a portable molding bench and a 180-pound anvil complete the equipment on this deck.

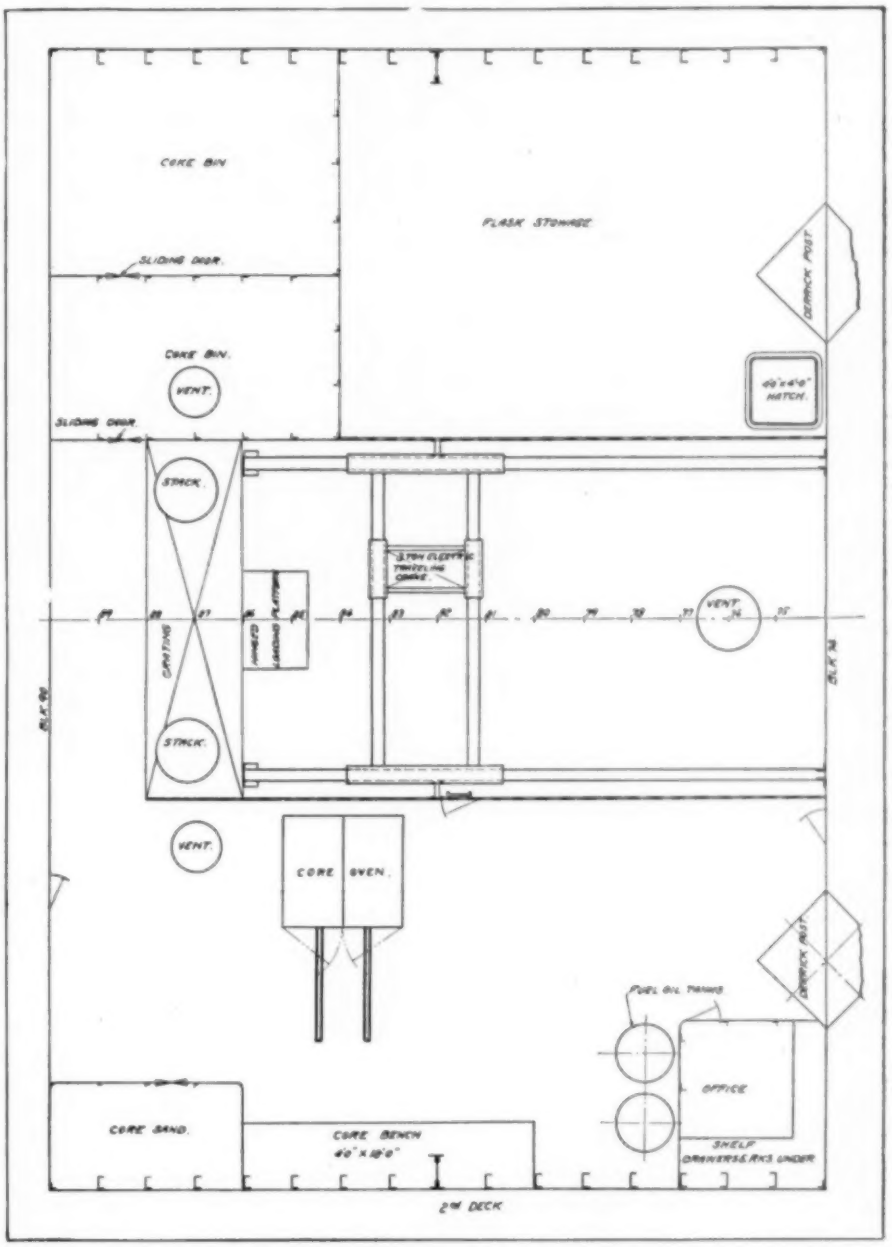

FIG. 3—ARRANGEMENT OF THE UPPER DECK LEVEL OF THE FOUNDRY—THE LOADING PLATFORM FOR THE 3½-TON CUPOLA IS LOCATED ON THIS DECK—PART OF THE EQUIPMENT IS KEPT ON THIS DECK

Two cranes are installed to handle material about the molding floor. The larger of the two is a 3-ton capacity made by the Pawling & Harnischfeger Co., Milwaukee and is electric throughcut. The second deck is cut away for about 10 feet on each side of the center line, and the crane trolley tracks are installed on the sides of the opening giving the crane a span of 18 feet. The trolley tracks are about 16 feet above the molding floor level. The arrangement to prevent the crane from taking charge in a seaway, when unexpected motion of the bridge or trolley might be dangerous to the personnel of the foundry is a special feature. The bridge truck wheels are bronze bushed and fitted free on the axle, while the truck gears are keyed to the axle and engage with steel racks one on each side of the span. The trolley drive is similar, the truck wheels being loose and the axle, while the gear wheels are keyed to the axle and engaged with racks attached to each bridge girder. Both the trolley drive

and the bridge drive motors are provided with powerful magnetic clam shell brakes capable of producing a holding power as great as the maximum torque of the motors. The motors are all direct current being of 6, 6 and 1 horsepower for the hoist, bridge and trolley respectively. All are arranged for floor control. Under full load, the hoist motor has a speed of 17 feet per minute, the bridge of 275 feet per minute and the trolley of 100 feet per minute. At light loads, these speeds are raised to 40, 325 and 150 feet per minute respectively. As may be seen from the floor plan of the third deck, Fig. 3, the 3-ton crane may serve both cupolas and the four brass furnaces, while the 40-foot hoist enables it to raise stores from the storeroom two decks below through the 6 x 6-foot hatch in the forward end of the foundry. An 8000-pound crane scale is provided for use with this crane.

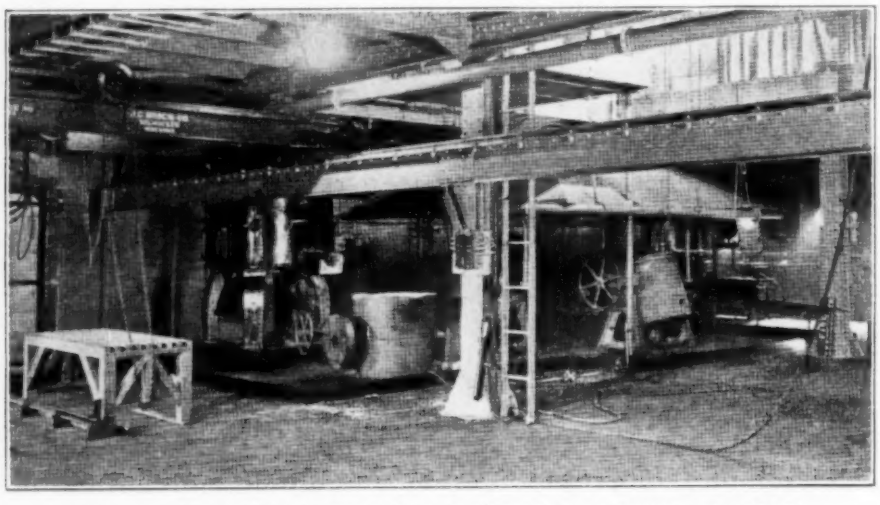

FIG. 4—FOUNDRY ON THE U. S. S. MEDUSA LOOKING TO PORT

Underneath the second deck on the starboard side is mounted the 1-ton traveling crane manufactured by the J. C. Busch Co., Milwaukee. This crane has power for hoist only, the movement in the fore and aft and thwartship directions being controlled by hand. The motor has pendants for floor control and has a hoisting speed of 33 feet per minute at full load. The crane has a span of 18 feet 11 inches and a hoist of 12 feet. This crane is used for handling molds in and out of the drying oven, empty ladles, flasks, etc.

The second deck is practically a gallery around the molding floor. The foundry office is on this deck where records and blueprints are filed, and the necessary paper work of the foundry carried on. Two, 250-gallon, oil tanks are installed alongside the office for supplying oil to the brass furnaces. Farther aft on this side of the deck is the core equipment with the core sand, core bench, and core oven adjacent to each other. The core oven is identical with the drying oven except that adjustable and removable shelves are provided in the upper part for holding small cores.

Amidships is the charging platform for the 3½-ton cupola and the brass furnaces. A loading platform served by the 3-ton crane is placed forward of the grating about the cupola and brass furnace stacks. On the port side are the coke bins and a large compartment for flask storage.

As the foundry must operate a large part of the time by artificial light, particular attention was paid to the lighting layout. Large hemispherical reflectors carrying 100-watt lamps are distributed through the foundry spaces placed so that ample light is provided for the various operations. The total electric demand of the lighting, heating and motor driven apparatus is about 90 kilowatts. Pneumatic lines are brought into the foundry from the air compressors for use with various air tools.

In addition to the equipment mentioned above, the following accessories and tools are provided: Two sets of crucibles for each brass furnace; brass pouring ladles, 60 to 200 pounds; lifting tongs, pouring shanks, hand ladles, skimming ladles, etc.; three geared crane ladles, 6000, 3000, and 1000 pounds capacities; chipping vise and hammers; pneumatic tools; four sets of brass molders hand tools; four sets of iron molders hand tools; two sets of core makers tools; thirty-six flasks ranging in size from 6 x 12 x 16 inches to 10 x 24 x 48 inches.

The necessary raw materials for use in the foundry must, of course, be carried aboard in such quantities as will last until the vessel may reach a base where supplies may be replenished. In ordinary times a six months allowance is usually kept, but for an extended cruise or in war time, the storerooms are filled to capacity.

The six months allowance of foundry stores for the MEDUSA includes the following:

Metal, Ingot of Pig

	Pounds
Aluminum	500
Antifriction metal	1,000
Antimony	1,000
Bronze	10,000
Composition	10,000
Copper	20,000
Iron No. 1 pig	50,000
Iron No. 2 pig	50,000
Lead	2,000
Tin	2,000
Zinc	1,000

General Supplies

	Pounds
Borax	1,000
Gravel	10,000
Clay, fire	10,000
Coke	40,000
Facing, silica wash	500
Facing, sea coal	1,000
Facing, plumbago	300
Flour	200
Fluorspar	300
Limestone	1,000
Parting	500
Sand, carborundum	1,000
Sand, Jersey	40,000
Sand, Jersey coarse	20,000
Sand, beach	1,000
Sodium silicate	40,000
Sodium silicate	100
Molasses	50 Gallons
Tapers	50
Bricks	1,500

Although not directly a part of the foundry the large pattern shop installed on the vessel should be mentioned, as the success of the foundry in a large measure is dependent on it. The pattern shop is on the second deck immediately abaft the gallery of the foundry. The following tools are installed:

One 30-inch surfacer.
One 26-inch universal saw table.
One 24-inch jointer.
One 24-inch x 8-foot bed lathe.
One 30 x 60-inch x 6½-foot gap lathe, 7-foot 4-inch swing.
One 30-inch sanding machine.
One 38-inch band saw.
One motiser and borer.
One oilstone grinder.
Two 2 x 12-inch double bench grinders.
Two 8-inch bench jointers.
One 15-inch portable floor trimmer.
Seven pattern makers vises.
Two 8½-inch bench hand trimmer.
One double spindle shaper 42 x 52-inch table.
Two 2 quart electric glue pots.

All the power machines are driven by direct connected electric motors.

With the above equipment, the MEDUSA, probably the largest foundry afloat, may turn out castings for almost any repair job aboard our warships, with exception of the large main propelling engine castings. The MEDUSA shortly will take her place as repair ship for the battle fleet and as such will be stationed in the Pacific, replacing the PROMETHEUS which is going out of commission.

The Federal corporation, 304 Lexington avenue, Pittsburgh, has acquired the Butler Foundry, Butler, O., and will continue to operate it making iron toys, small stove parts, plumbing castings, brake shoes, etc. The foundry will be enlarged to take care of anticipated requirements. J. H. Hall is superintendent.

How Mesta Makes Molders

In the Foundry Trades the Shortage of Trained Workmen Is Becoming Alarming—Training Young Men To Supply the Deficiency Is Remedy of Pittsburgh Shop

BY R. A. PEEBLES

MEN who have mastered a trade are scarce. Quantity production tends to narrow the scope of each man's activities. With the restriction of his work to a single operation or a short connected series of operations, a natural tendency is encountered to learn the operation and neglect the remainder of the manufacturing process. The heavy premium placed on speed strongly favors this tendency. Green men are brought into a manufacturing plant and put through a brief course of training on a particular operation. In a few days they are able to *run a machine* or *get away with the job*. For a number of years previous to the war it was noticed that well trained workmen were becoming rare. The war woke us up for a brief period, to the necessity for training men. After that period of stressful struggle, a majority of firms lapsed into their former indifferent attitude.

In the foundry trades, the shortage of trained workmen has become alarming. The National Founder's association, in a circular letter to the membership, dated Oct. 27, 1922 urges the training of more men in the foundry trades. From the estimate of the situation the nation is at least 30 per cent short in this particular branch of skilled labor. A few shops it is stated were making earnest efforts and getting results; but many, unfortunately, were doing absolutely nothing. This was borne out by a partial census of the firms in the Pittsburgh district taken about a year ago to determine the status of foundry training. Out of about 40 of the larger concerns consulted only two or three were doing anything toward training apprentices.

The company with which the author is associated, builds a variety of heavy machinery and long since realized that the considerable number of skilled mechanics required in the work could be secured only by a thorough course of training in its own plant. The machine and pattern trades are given their share of attention in our plant, but because of the prevailing scarcity of skilled foundry workers, naturally we have laid considerable stress on apprenticeship in the foundry trades. This article is confined to this particular branch of the metal trades.

The work handled in the foundries of this company covers a wide range in both iron and steel castings. Some are light enough that the flasks may be handled by the molders themselves, while those on the main floor are up to the limit of present day equipment. Because of the nature of our work no molding machines are used. For the same reason a great number of our

AGE CERTIF. OK — EXPER SHEET ✓ — RECORD FORM ✓

APPLICATION FOR APPRENTICESHIP – QUESTIONAIRE.

Name William Smith — Birthplace Pittsburg — Age 16Y-5M Date of Birth 9/17/06
Address, 713 Jones St. Homestead, Pa. — Telephone none
Nationality of Father Amer. Nat? — Mother Amer. Nat.? — Religion? Meth.
Grade School Homestead Grade Compl. 8 — High School — Yrs —
Left School Will leave 5/19/23 Reason Comp. 2 long term – Wishes now to take up trade
State How Long You Studied These Subjects – Algebra — Geometry —
Mech. Dwg 1 yr. Wood Work 2 yrs. Mach. Shop — Nat. Science —
Have You An Age Certificate From The Principal Of Your School yes
Trade Preferred. Indicate Choice By Number

Machinist	Roll Turner	Gear Maker	Toolmaker	Pattmaker	Molder	Core Maker	Electrician
2					1		

Why Do You Select This Trade? Believes he will like the work
Are You now Employed? no If So, by Whom? —
At What Sort of Work? — If Not, Why Not? Still in school
By Whom is Your Father Employed? Carnegie S. Co. What Does He Do? Laborer
What Books Do You Like? Boys – Cadwell. Alger – Cooper – Reads a great deal. Magazines Pop. Mech. Pict. Review. Ladies H. Journ.
Do You Take Any Interest in Baseball? yes Basketball? no Football? yes Boxing? no
Music? no Night Schools? no Corr. School? no Movies? yes Clubs? Scouts Pool? no
Do You Chew Tobacco? no Smoke? no
Recommended by — Address —
Name of Parent or Guardian John Smith
Address-No. 713 Street Jones Town Homestead
Will You Sign a Four Year Contract if accepted? yes
Can You Pass a Physical Examination? yes Height 5'-5" Weight 115 Glasses? no

	1 2 3 4 5 6 7 8 9 10	
Personality	+	8
Attitude	+	9
Confidence	+	8
Neatness	+	9
Schooling	+	x2 · 12
Knowledge	+	x2 · 16
Alertness	+	x2 · 18

Percentage Grade 80

Time Already Serve on Trade —
With Whom? —
Written Credentials —
Hired to Start 5/19/23 at —
Department Iron Foundry Side Floor
Foreman Andrews

Interviewed by R.A.P. Date 5/3/23

Term	Begun		Grades		Term	Begun		Grades	
1	5-14-23	Reported by foreman as low except for occasionally steady worker	Shop	B	5			Shop	
			Class	B				Class	
			Attend.	A±				Attend.	
			Deport.	B				Deport.	
			Average	B				Average	
2	10-22-23		Shop	A±	6			Shop	
			Class	B				Class	
			Attend.	A±				Attend.	
			Deport.	A±				Deport.	
			Average	A±				Average	
3	2-9-24		Shop		7			Shop	
			Class					Class	
			Attend					Attend.	
			Deport.					Deport	
			Average					Average	
4			Shop		8			Shop	
			Class					Class	
			Attend.					Attend.	
			Deport.					Deport.	
			Average					Average	

General Information 16 yrs. 3 mos. old when started Completed 8th grade

Term Record

Smith William — Molder — 5/14/23
Name — Trade — Begun — Compl.

FIG. 1—QUESTIONNAIRE USED TO BRING OUT APPLICANT'S PERSONAL QUALIFICATIONS. FIG. 2—A GENERAL RECORD OF THE APPRENTICE'S STANDING IN SHOP, CLASS, ATTENDANCE AND DEPORTMENT

The author is director of education Mesta Machine Co., Pittsburgh.

molders must be good mechanics having a wide general experience.

In starting the training of molders and coremakers it was apparent that we could not rely upon applications for these trades. No prospects applied. It was necessary to go out and explain the proposition to the right sort of boys and their parents. Applications for apprenticeship positions were chiefly for the pattern and machinist's trades, more than half of the applicants selecting the pattern shop. In the author's opinion this is due to the fact that the majority of schools give manual training in woodworking only. The boy finds this sort of work clean and pleasant and if fairly

about 15 feet long by 6 feet wide. If a melting furnace for soft metal is out of the question, the molds may be cast with a thin plaster of paris mixture. Manual training at best is not trade training and is intended to develop the natural tendencies of the pupil, and implant correct ideas of the trades covered. Most boys, having never seen a foundry, accept their impressions from their parents or teachers. The author knows of one case in which the instructor in manual training, a patternmaker by trade, told his class that it took brains to make patterns, but anyone could make castings after the patterns were ready. The school presided over by that man has

healthful trades. It is no trade for one who is looking for a sinecure. It means activity all day long and a tired body at quitting time. It is as safe as the average trade, in a modern foundry, heated in cold weather and well ventilated at all times, with hot metal handled by cranes or by hoists running on overhead tracks. The elements of danger from dust or hot metal are no greater than the ordinary hazards found in average shops. In the opinion of the author, they are not nearly so serious as the hazard from the sanders and jointers used in any pattern shop.

Notwithstanding these difficulties we usually are able to sort out from the

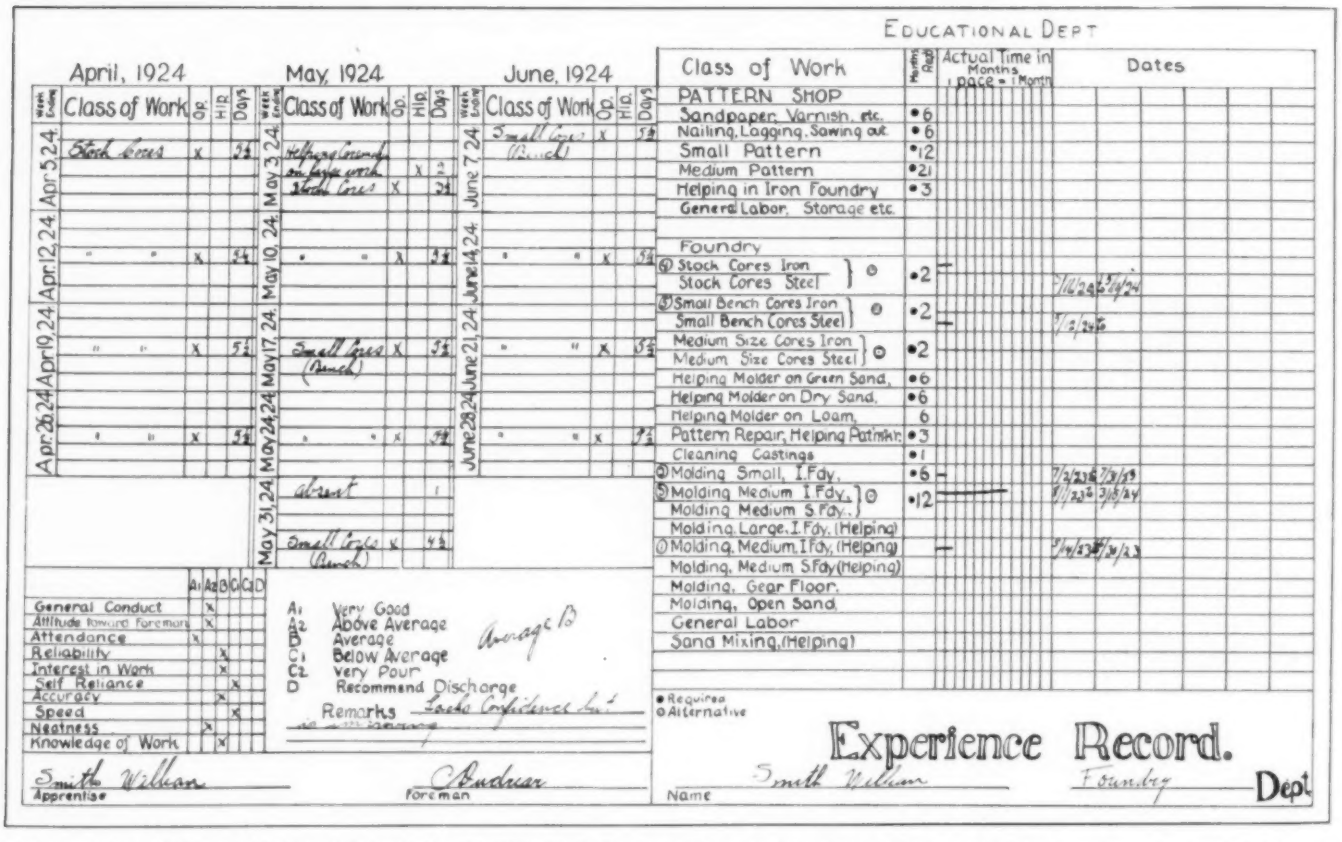

FIG. 3—A FORM TO RECORD APPRENTICE'S EXPERIENCE DURING EACH CALENDAR QUARTER. FIG 4—SUMMARY OF APPRENTICE'S EXPERIENCE THROUGHOUT HIS ENTIRE COURSE

successful at it he easily persuades himself that it is the trade to which he is most suited.

A word should be said here about manual training as affecting foundry work. Except in small schools where funds are limited and only the most elementary sort of instruction can be given, there is no reason why manual training should be so confined to woodworking. A molding tub long enough to accommodate five or six boys, with an outfit of wood or metal flasks and a few necessary tools is an inexpensive addition to the manual training equipment. The whole installation with a supply of sand would cost hardly as much as a single lathe and would occupy a space only

good molding equipment, and the last time the author visited the molding department, it was in use as a pattern storage room. Each year a large class graduates from that school in pattern making, machine work and drafting; but none in molding.

In addition to the handicaps mentioned many parents try to guide their boys into the *easy* trades. They forget, or perhaps they do not know, that a ***man's mental attitude makes his work easy or hard as the case may be.*** Most of the heavy work of the molder, such as sifting, ramming sand, and lifting flasks, is done by mechanical means. Such shoveling and ramming as must be done by hand makes molding one of the most

applicants that present themselves, enough suitable boys for the foundry. A certain premium, such as a higher rate of pay, is placed upon the selection of the foundry trades. Where other considerations are balanced the higher rate of pay usually determines the applicant in favor of the foundry. Of course, it is necessary to guard against boys selecting foundry work solely on account of the higher rate. This is taken care of by a careful questionnaire shown in Fig. 1 and designed to bring out the applicant's personal qualifications. This further is assisted by mental and physical examination.

In determining the percentage grade, the first items are estimates. Under the

head of schooling, 10 is taken to mean 4 years of high school of which 1 stands for third grade. Knowledge, mentality, and alertness are determined by examination. Double weight is given to schooling and alertness.

Describes Regular Course

Apprentices starting between the ages of 16 and 18 years are classed as regular apprentices. They receive the regular course of instruction in class and shop and their rate of pay is determined by a prearranged schedule of hour-rates which is the same for every regular apprentice in the foundry department. Normally, we carry about one regular apprentice to five journeymen.

Regular apprentices are taken under contract for a period of training, nominally four years in length. The course is divided into eight terms of six months each. Since superior mental and physical qualifications enable some boys to acquire the essentials of their trade at a faster rate than others, it was felt that this difference should be recognized by shortening materially their period of apprenticeship. A boy is placed on trial for a period of three months, at the end of which time he is given a grade based on his attendance, deportment and his progress in shop and class. This grade determines the number of hours he shall serve to complete the first term of his course, as follows: Grade A, 1053 hours, or 75 per cent of the full term of six months; grade B, 1228 hours, or 87½ per cent of the full term of six months; grade C, 1404 hours, or 100 per cent of the full term of six months.

The apprentice is examined at the end of each term, his grade fixing the number of hours he shall work to complete the next succeeding term. Determining the grade is a matter of importance, and also of some difficulty, because not every foreman is able to consider the work of the apprentice without prejudice for or against him. For this reason, the form shown in Fig. 3 is used. This form covers the apprentice's experience during each calendar quarter and is filled in each week by the apprentice himself. At the end of the quarter the record is submitted to the foreman for his estimate of the boy's standing. Ten characteristics are considered, a separate grade being given for each. This is to obviate the tendency shown by some foremen to give a good boy or a personal favorite higher grades than their actual ability warrants or to disparage a boy disliked for personal reasons. Should such a tendency be shown it is explained to the foreman that only an exceptional boy could grade extremely high in all of these characteristics. On the other hand, it may be shown that no boy who passed our physical and mental tests would be likely to grade low in all, or even in a majority of them. By the time a boy has been discussed and graded by two or three successive foremen, the educational department will have arrived at a fair estimate of his real ability.

A summary of the apprentice's experience throughout his course is kept on the experience record as shown in Fig. 4, entries being made at the end of the quarter from the form shown in Fig. 3. A general record of his standings in shop, class, attendance and deportment, with dates of promotion, increases in rate and any general information is kept on the term record form, Fig. 2.

Regular apprentices receive instruction in the class-room twice per week, four hours in all, during which time they receive their regular rate of pay. They are expected to put in an equal amount of time on their studies at home. The course of instruction covers mathematics, mechanical drawing, sketching from objects, general science, economics, and trade subjects. The mathematics includes a general review of arithmetic, algebra, through simple equations, a short course in plane geometry, and the use of trigonometrical functions in solving problems involving the right triangle. In drawing, it is our aim to teach the apprentice to read drawings, rather than to make them. However, he should be able to make drawings of simple parts. For this reason, most of his drawing is done on cross-section paper, using only scale and pencil compass. General science and economics are taught partly by short talks on a series of subjects, and partly in connection with applied mathematics or shop problems. Twice a month each class is addressed by one of the shop superintendents on subjects concerning his particular trade or the work of the plant in general. These talks also are open to the special apprentices, who are given notice to attend. Every superintendent is expected to respond for this duty on proper notice.

The shop schedule for regular apprentices in the foundry department is as follows:

	Months
Stock cores, iron or steel core room	2
Small bench work, iron or steel core room	2
Medium size work, iron or steel core room	2
Helping on green sand	6
Helping on dry sand	6
Helping on loam	6
Pattern repair	2
Cleaning castings	1
Molding, small, iron foundry	6
Molding, medium, iron foundry	12

These items cover 45 months. In some cases a boy may remain in a department longer than the scheduled time, but if his progress is what it should be, this will not occur often. The remaining three months covers such irregularities. In case an apprentice receives an *A* or *B* grade, his time in each department will be shortened in proportion.

After completion of the course, the apprentice is placed on the work for which he seems best fitted, his own preference being consulted so far as possible.

Regular apprentices receive, during the first term of their apprenticeship, 35 per cent of the wages paid to journeymen of the second class. The rate is advanced by regular increments until during the eighth term they are earning 80 per cent of this rate. At the conclusion of their apprenticeship they are advanced to the full rate of second class journeymen.

Special Course Provided

It was recognized that many older boys and young men would be glad to learn a trade but were deterred by the low rates paid to regular apprentices. Most boys past 18 years of age must earn their living or assist in the maintenance of the home. It was decided that boys and young men above that age who were ambitious to learn a trade or some branch of a trade, should be taken on as special apprentices Such prospects are subjected to the usual physical examination and while no formal mental test or examination is given, they are questioned carefully, both by the educational department and by the department superintendent under whom they are to work. They are hired by mutual agreement of the two as to fitness, etc.

Special apprentices are paid the rate given to common labor at the start and are advanced according to their earning power. Those who have limited education and natural ability are trained in one line of work only. They become steel coremakers, roll molders, etc. Some of these men quickly show themselves to be above the average in ability and are given every opportunity to become competent foundrymen. A few men, graduating from technical high schools or trade schools take this means of gaining the experience necessary to make them competent.

The rates and standings of special apprentices are reviewed each month by the educational department with the foundry superintendent, that progress or lack of progress may not be overlooked. A record of the experience is kept on the same form as that used for regular apprentices, and grades are taken each quarter in the same manner. These men remain in training about two years. They are given a certificate at the end of their training period, covering the line of work in which they have become proficient.

In most foundries supervision is subdivided sufficiently that the foreman can act as instructor, and it is the

author's opinion that where this is feasible and the foreman competent, he should so act. This company tried this method first and then secured a first class man of good record as molder and foundry executive to take charge of all foundry apprentices. We have returned to the first method. The special instructor, handling apprentices under several different foremen, must be a high grade diplomat as well as a first class foundryman, else there will be constant friction. We have not located such a paragon and believe that by keeping in close touch with our foremen and leaving details of shop training and discipline to him, good results will follow.

The apprentice is hired by the educational department and remains under its general supervision to the end of his course. This, with the close personal touch kept by the educational department with both apprentice and foreman, and the active interest of the management in the sysetm, is sufficient guarantee against irresponsible activity on the part of an irritable foreman. The movement of apprentices from one department to another is handled by the educational department, but in this matter, wherever the nominal control, it must be understood that *co-operation* is the key to any successful training program. A foreman or superintendent who is not in sympathy with the movement can nullify all efforts in this direction if permitted to do so.

For this reason, it is necessary that the management take a firm stand at the start. The training program should be put on the same basis as production, a duty required of the various departments by the management. If this essential step is not taken, no amount of effort or expense on the part of the most competent educational department will avail. The tendency is to satisfy the demands of the management in exact proportion to the urgency of such requirements.

Our interest is in training competent molders and coremakers, not foremen and superintendents. If every firm shoulders this burden of training boys to be good workmen, enough of foreman material will develop in a natural way, and may be trained by other educational agencies in the principles of foremanship. The technical schools turn out many men qualified to take charge of foundry work after they have received some practical training. Some of these men already have had some years of practical experience in the trade before taking up the technical course.

So much has been written in recent years about the proper methods of instruction in the shops, by men who have extended experience to lend weight to their opinions, that the reader is likely to be confused in his attempt to coordinate and make use of the information. However, analysis of the data brings out the main thought that the apprentice should be taught basic principles and to apply them to his work in a rational manner, considering the reasons for each step. Teaching by arbitrary methods is decried as unscientific and inefficient.

If every boy were capable of learning and successfully applying basic principles, we should need few foremen or superintendents; merely a few clerks to tally the output of these super-mechanics. Unfortunately, we must deal with humanity as we find it. Authorities on the subject of mentality tell us that each person enters the world with certain mental possibilities. These, like his physical gifts, may or may not be developed to the full in later life, but they are as fixed as his stature. No amount of effort can push the individual beyond these limits, which are determined almost entirely by heredity. Mentality tests on hundreds of thousands of subjects have established that in a given hundred average persons, only four or five will possess first class reasoning powers, and perhaps 40 per cent will be capable of acquiring knowledge in varying degrees by strictly rational processes.

Intelligence is only one of the activities of the mind, and its operations are influenced by other elements, such as the emotions, and physical condition. Therefore, it follows that even with careful selection by mental and physical tests and by questioning, some poor selections will be made. We do not wish to be understood as decrying the effort to train boys to approach their work in a rational manner. This should be aimed at in *all* cases, but the instructor who knows human nature as it is, will understand that results will range all the way from near perfection to practical failure. But of the average 10 boys who finish a trade, one or two will develop into first class mechanics who understand the principles of their trade, five or six who will become fair average workmen, using some reason in their daily work, and two or three who may know the manual operations of the trade, but will always have to be under close supervision because they are too unintelligent or too mentally inert to do their own thinking. Therefore, it is useless to discuss apprenticeship training as though the foreman or the instructor were at fault if every apprentice did not develop into a foreman or superintendent or even into a first class workman.

It is to be hoped that the publication of various training programs will stimulate interest in this vital matter of training men for the foundry. The author also would offer the suggestion that the National Founders' association might work out a training scheme with suitable texts along the lines followed by the National Metal Trades association in their apprenticeship training scheme for machinists.

Book Review

A Laboratory Manual of Machine Shop Practice, by Terry H. Service and George E. Frease, 106 pages, cloth, 5¼ x 7¾ published by the D. Van Nostrand Co., New York, and supplied by THE FOUNDRY, Cleveland, price $1.25 net.

The teaching of vocational subjects is best conducted by men and women who have made a success of their respective vocations for a considerable length of time and who are thoroughly familiar with commercial requirements and commercial methods. Such persons often experience difficulty in organizing and conducting a course that will develop in their students the ability to master the several subjects.

This book has been written primarily to assist this type of teacher. It is intended to help practical machinists to organize and conduct a vocational course that can be followed in the shop. It will serve as a guide for the preparation of the lecture part of the course.

The jobs given in this manual are designed to cover the essential bench, drill press, engine lathe, milling machine, planer and shaper operations. In schools equipped with grinders and special automatic machinery, the jobs may be supplemented by the teacher with additional job designs to cover the essential operations on those machines. Chapters are devoted to measurements, how to read the micrometer caliper, emery wheel, identification of iron and steel, tool grinding, belt lacing, etc.

In the appendix a list of equipment is given that may be issued or sold to each student as his individual equipment for the course. Topics are suggested for lectures, group discussions and assigned reading.

Plans New Foundry

The new foundry building for which the United States Cast Iron Pipe & Foundry Co. now is in the market for construction at Burlington, N. J., is to be approximately 120 x 600 feet. The new unit in addition will have a cleaning shed and other service units which will make the total width about 550 feet. The new building will be equipped for the manufacture of cast iron pipe by the centrifugal process.

The Austin Co., Cleveland, has removed its Los Angeles, Cal., office to 777 E. Washington street.

Describes Bell Founding-I

Historical Notes Covering the Early Methods Employed in Developing the Bell Founders Art—The Introduction of Large Bells Is Credited To Italy About the Fourth or Fifth Century

BY WESLEY LAMBERT AND GEORGE HALL

HOW the bell originated, or by whom it was actually invented, is lost in antiquity. Josephus tells of bells fixed on the golden roof of Solomon's Temple to keep the birds from alighting thereon, which bells, presumably, were not much larger than the present day hand-bell. Suetonius mentions that Augustus caused a bell to be hung before the Temple of Jupiter. It is recorded that Julius Caesar on landing in Britain heard the tinkling of the bells upon the spear shafts of the assembled warriors. Large bells—such as one is now familiar with—were not known until the early centuries of the Christian era. The introduction of the large bell has been ascribed to Italy, both Bishop Paulinus of Nola, about the year 400, and Pope Sabinianus, about the year 600, being accredited with effecting its introduction. The Venerable Bede brought a bell from Italy to place in the Abbey of Wearmouth in 608, and mention is made of a bell being in use at Whitby Abbey at about the same time. S. Ethelwold, Bishop of Winchester, 923-984, was responsible for the casting of the bells for Abingdon Abbey. Ingulphus, the chronicler of Croyland Abbey, mentions that a peal of seven bells was hung there in the tenth century, and that there was not such a harmonious peal in the whole of England, a statement which implies that *rings of bells* were common at that time. Of early bell-founders, London can claim as citizen, Alwoldus, a *campanarius* or bell-founder as early as 1150. In the reign of Richard I of England the Guild of Saddlers was granted the privilege of ringing bi-weekly the bells of the Priory of S. Martins-le-Grand. The priory being entitled to claim the sum of 8 pence for *ringing* at the funeral of deceased members of the guild.

An ancient bell having the date of 1133 *cast* upon it was recovered from a pond at Preston in 1897. It is stated on good authority that the bell at Fontenville, Bayeux, in France, bearing the date 1202, has the distinction of having been in continuous use for the greatest number of years. In England, what is believed to be the earliest church bell is to be found in St. Chad's church, Claughton in Lonsdale, Lancaster; it bears the date 1296, and although a small bell, it has done duty for over 600 years. Bells of large size were founded as early as the twelfth century, about which period a tenor bell was added to the ring at Canterbury Cathedral. The complete ring of bells requiring 32 men as ringers. This bell was surpassed by one cast in 1316 which weighed 3½ tons. John of York was a noted bell-founder about the middle of the 14th century; at Sproston in Leicestershire there is a bell inscribed in Latin, "John of York made me in honour of the Blessed Mary."

Harmony by Exchange

THIS paper prepared by Wesley Lambert and George Hall of London, England is one of a series exchanged between the Institute of British Foundrymen and the American Foundrymen's association. This is the third annual exchange paper presented by the British organization and was read at the Milwaukee convention. This section deals with historical notes on bells and the early methods used in founding together with a description of a number of the best known bells. The second part which will appear in an early issue will be devoted to a description of the present day methods of molding bells. The third section will take up in considerable detail the mixtures used, pyrometric control of the melting, correct pouring temperatures and other metallurgical problems involved in producing the rich sonorous qualities of the bell metal.

The following list includes the best known English bells:—

Name	Place	Weight tons
Great Paul,	St. Paul's Cathedral	16-17
Big Ben,	Westminster	13-14
Great Peter,	York Minster	12-13
Great John of Beverly,	Beverly Minister	7- 8
Great Peter,	Exeter Cathedral	6- 7
Great Tom,	Oxford	6- 8
Great Tom,	Lincoln Cathedral	4- 5

Westminster town hall, London, possessed a bell famous for its connection with a story told as happening in the reign of William III, of a sentinel at Windsor castle, who was accused of sleeping at his post. He defended himself by stating that he was not asleep, but that he was placing his ear to the ground in order to hear the Westminster clock strike at midnight, and that he not only heard it, but that it struck 13 instead of 12. It was subsequently attested that the clock did, on that occasion, actually strike 13, and the soldier was acquitted.

The bell of Lincoln's Inn chapel, London, formed part of the spoils at the capture of the City of Cadiz by Lord Effingham of Good Queen Bess' days, and was brought to England by the Earl of Essex, favorite of that queen, in 1596. Notwithstanding the general discontinuance of the ringing of the curfew at the end of the sixteenth century, the bell at Lincoln's Inn chapel continued to be rung and the custom is still maintained, the curfew being rung nightly at 9 p. m. The bell is tolled 50 times, a pause being observed after the first and before the last strokes.

The great Westminster clock-bell, Big Ben, was no named after Sir Benjamin Hall, who was in office as the parliamentary first commissioner of works at the time the bell was cast. The original bell was made by Messrs. Warner, of Stockton-on-Tees, but it developed a crack during its public exhibition at the foot of the clock tower, and the bell was recast by Messrs. Mears of Whitechapel, London; it weighs 13½ tons.

The known largest bell in existence is the great bell of the Kremlin, The Monarch of Moscow. The value of the metal used in the casting alone was said to exceed 66,000 pounds sterling. The casting is now defective, a considerable piece having been broken away from the side owing to a fall in 1737. The accompanying table is a comparison of the estimated weights of the heaviest bells of which records are available.

Place	Tons	Diameter feet	inches
Moscow	220	22	8
Trotzkoi-Russia	171		
Moscow	110	18	0
Mandahay-Burmah	87	18	0
Moscow-S. Ivan's Ch.	57	18	0
Pekin	53	14	6
Novgorod	31		
Moscow	28½		
Cologne Cathedral	25½	11	3
Nanking	22		
Lisbon Cathedral	21		

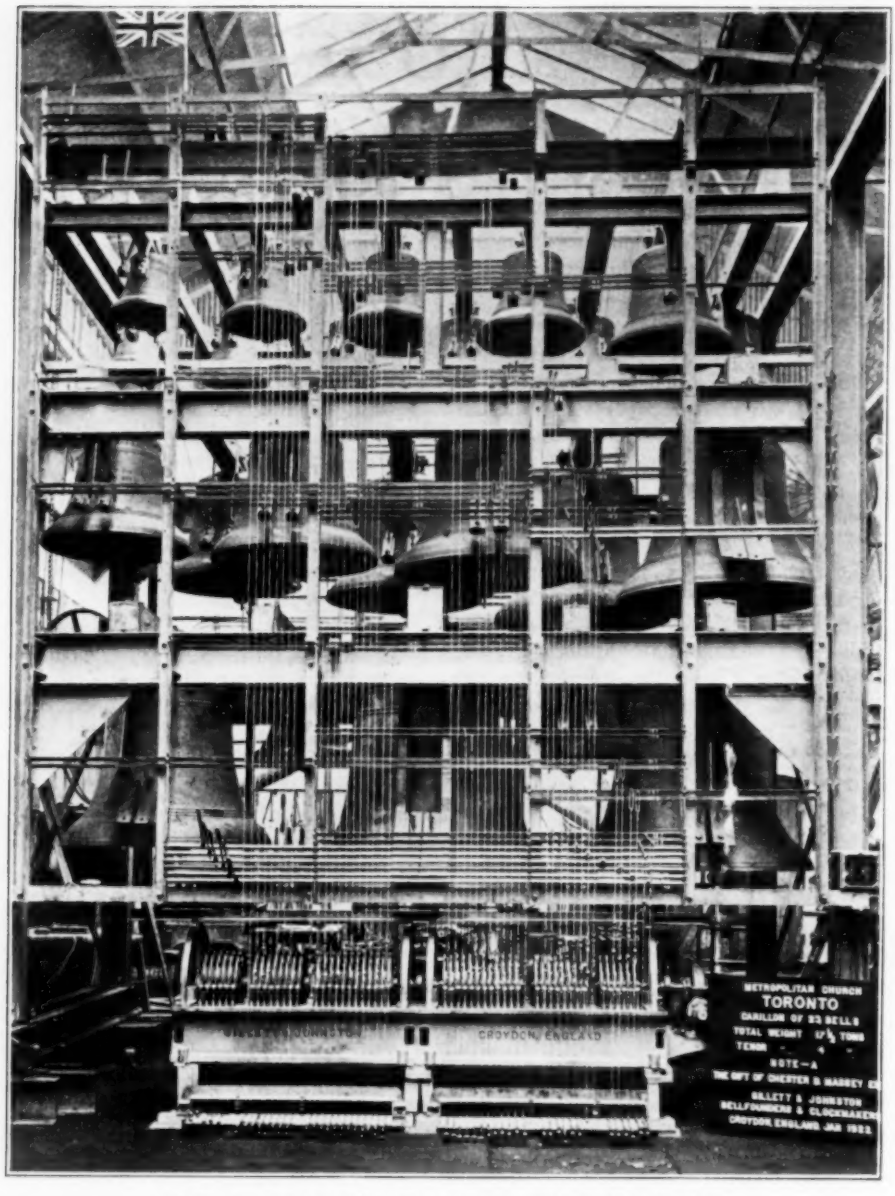

FIG. 1—A CARILLON OF TWENTY-THREE BELLS

Kioto-Japan	20	10	0
Paris (Montmartre)	18½	9	11½
Vienna	17¾		
London (Great Paul)	16¼	9	6
Rouen	16		

When large bells were required in the early days they were cast locally ready to be placed in the belfry or bell-tower. The bells of York Minster were molded and cast within the Minster walls. The principal reason for so doing, was the absence in those days of good country roads, and the difficulty of road transport of heavy bells was therefore practically insurmountable.

Bell founding was for centuries a slow process. The appliances for *striking-up* and lifting the mold, and also the furnaces for melting the metal were all crude. However, the old-time bell-founder was an expert craftsman among his fellow-men, and speaking generally, the craft was handed down from father to son. Robert Alton made me 1633. Robert Alton, upon receiving an order to make a bell or a peal of bells for a certain church would proceed to erect his temporary foundry near the church itself. He would commence actual operations in the foundry by building up a core for the mold in a hole dug in the ground. The base-plate was either of wood or iron. The core-spindle was mounted in a socket set in the center of the base-plate. Having built the core with bricks and clay by the aid of a sweep, the core was dried by a charcoal fire. A second sweep was then placed into position and a thickness of sand or loam struck on the core, conforming to the finished shape of the outside of the bell to be cast; any inscription being formed in wax and carefully fastened to the sand or loam, which wax in the drying process melted away, leaving the imprint of the letters in the cope or outer case of the mold. The outer case of the mold was in its turn subjected to the process of drying. The cope was formed of brick-work and loam by building-up the same on a large iron ring until the core and bell-thickness was completely enveloped. After a period of drying this outer part was lifted, then thoroughly dried and finally washed with a charcoal-and-clay wash to give it the requisite smooth surface. The bell-thickness was then removed from the core, and when the complete mold was re-assembled, a space was left between the cope and the core, of a shape and thickness corresponding to that of the bell required. The cope or outer case having been put back into position, the complete mold was rammed tightly in the earth, and wedged in with timber to support any strain set up in the casting operation. Simultaneously with the molding operations a furnace had to be erected. The furnace of Robert Alton's day was on much the same lines as the reverberatory furnace but on account of its temporary character somewhat more crudely built than the furnaces to be found in modern bell foundries. Charcoal was the fuel used for melting the bell-metal. A hole in the side of the furnace served as a tapping-hole, communication being made between the furnace and the mold by a sloping channel. Great care must have been exercised in the metal and the temperature of casting. Many old bells cast as long ago as the fifteenth and sixteenth century are made of much better metal than some of the bells cast within the last few decades. The old bell-founders had much to their credit as skilled craftsmen, and considering the difficulties to be surmounted in the exercise of their craft, they must have been men of strong will and courage. Robert Alton, having cast a bell and allowed it to cool off, would then proceed to strip it from the mold and to clean it up a bit with the object of making as presentable a bell as possible. He would then sound it carefully in order to observe whether it yielded a correct note. A musician with a violin sometimes being engaged to assist in the tuning; chipping being resorted to until the correct note was obtained.

Neither the contour of the bell, nor the art of bell-founding has changed, except in minor respect, through many centuries. Useful knowledge has been gleaned from the study of the products of the old bell-founders. In early days bells were not *rung up* as they are are now, but were simply *chimed* and sounded as a result of swinging the bell just sufficiently to strike the suspended clapper, or the bell remaining stationary, the clapper being swung. The latter was

a most deplorable practice, and a custom which accounted for many cracked bells. That this was realized as early as the sixteenth century is shown by the Churchwarden's accounts of St. Lawrence, Reading, for 1584, in which an entry appears as follows:—

"Whereas there was, through the slouthfulness of the sextun in time past a kind of tolling ye bell by ye clapper rope; ye was now forbidden and taken away."

When *rung up*, as is now the practice, the bell swings through a little more than a complete circle, and after each stroke rests in an inverted position, the mouth uppermost against a stay, until the rope is again pulled, when it swings down, strikes the clapper, and reverts again to an inverted position on the other side of the arc.

The inscriptions and markings found on old bells are often quaint and sometimes peculiar. Occasionally, here and there, a bell of freakish shape has been hung, and such a bell usually possesses a somewhat displeasing tone. There is a superstition that bells shiver and quake on the occasion of a crime or disaster. The bells of Canterbury are said to have rung without human agency when Archbishop Beckett was murdered, as did the bells of Lincoln at the burial of St. Hugh, the Lincoln martyr:—

FIG. 2—OLD TIME TUNING OF BELLS

"A' the bells o' Merrie Lincoln
Without men's hands woe rung;
And a' the books o' Merrie Lincoln
Were read without men's tongue;
And ne'er was sich a burial
Sin Adam's days begun."

It is placed on record that high festival was often observed before church-bells were hung in the belfry. The casting was used as a receptacle of liquid refreshment for the enjoyment of the assembled parishioners!

York possesses two interesting memorials having reference to the art of bell-founding. The one is an ancient cross erected to the memory of an unknown craftsman. On one side of the cross is a brazier or furnace, and on the other is the figure of an antique bell. The second memorial takes the form of a stained-glass window in the nave of the minster, and is known as the Bell-Founders' Window. Several of the operations involved in casting a bell are represented. The mold for the bell is shown in vertical section, and the metal is seen running into the mold. The man (over life size) is teeming the metal from a crucible; an assistant is holding back the dross. The window was presented to York Minster in 1320 by Richard Tunnock, Bailiff of the city. An inscription on an old bell at Richmond Surry, England, reads as follows:

Lambert made me weake, not fit to ring,
But Bartlet amongst the rest hath made me sing.

W. L.

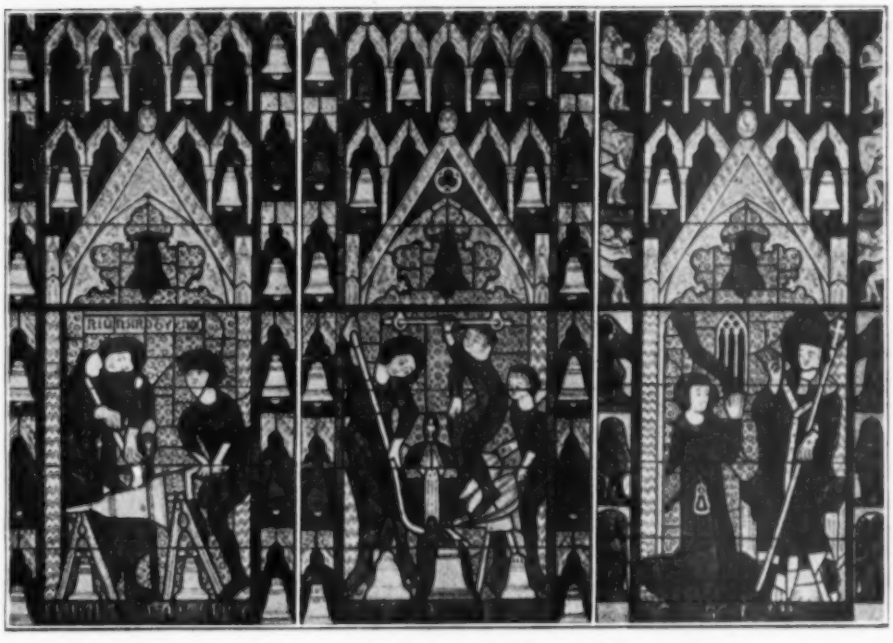

FIG. 3—BELL-FOUNDERS' WINDOW YORK MINSTER

Small Cupola Will Melt Without Slagging

Question: We should like to have your opinion on the necessity of slagging a 24-inch cupola melting 2 tons of iron.

Answer: Under ordinary circumstances it is not necessary to slag a 24-inch cupola while melting 2 tons of iron. However, occasions may arise where it is not only advisable, but absolutely necessary that the slag should be drawn off during the progress of the heat. For example, a coke high in ash, used in conjunction with rusty scrap will produce an excess amount of slag which must be removed if the cupola is to be operated efficiently. Even on small heats where the slag is not drawn off, it is advisable to throw a shovel full of limestone on every charge. This practice will keep the furnace open, insure a clean drop and reduce the amount of picking required to put the lining in shape for the following heat.

Large Castings Crack

By George A. Drysdale

Question: We art having trouble by the cracking of large castings due to the cores not yielding in cooling. The mixture used for the cores is composed of one part pitch and 38 parts gravel and old heap sand.

Answer: We note that your core mixture is one part pitch and 38 parts gravel and old heap sand. The pitch used for core compounds generally is derived from the by-product ovens in coke making. It has a high carbon percentage, consequently when the molten iron comes in contact with the core, a cooking process ensues which makes the core harder than it was originally. Sea coal often is added to reduce the hardness due to the coking tendency. Another means of overcoming this cracking is to soften the core by using less binder.

The department of commerce announces that according to data collected at the biennial census of manufacturers, 1923, the plants engaged primarily in the production of aluminum castings, bars, plates, sheets, ware etc., reported products valued at $106,930,367 an increase of 133.4 per cent as compared with 1921 the last preceding census year.

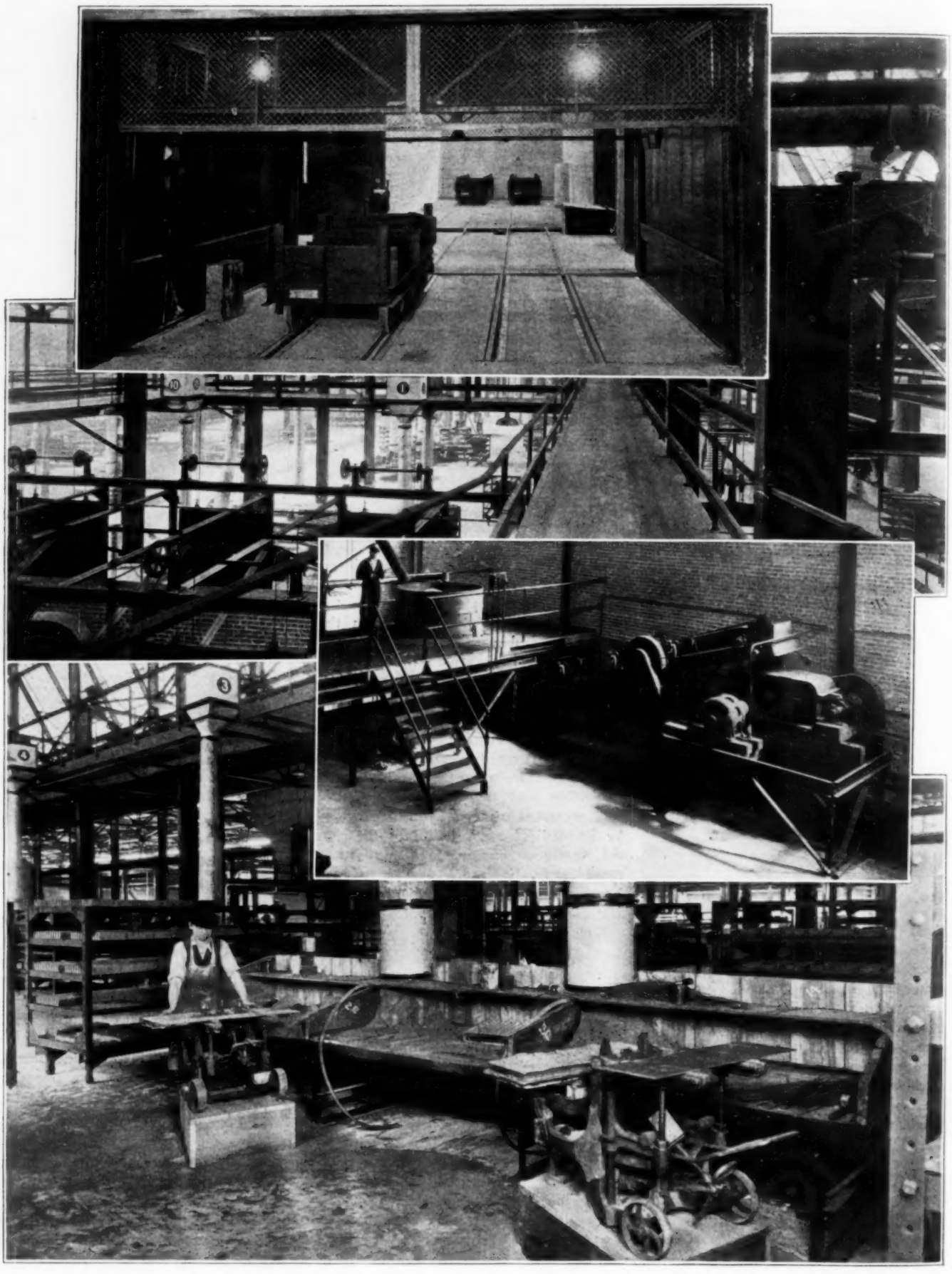

FIG. 1—ELEVATORS SERVING THE CUPOLAS ARE EQUIPPED WITH DOUBLE TRACKS—FIG. 2—ONE OF THE RUNWAYS ON WHICH CORE SAND IS DISTRIBUTED TO THE VARIOUS COREMAKING STATIONS—FIG. 3—SAND IS DROPPED ON THE CORE BENCH THROUGH A VERTICAL PIPE—FIG. 4—EQUIPMENT FOR PREPARING THE FACING SAND CONTINUOUSLY

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TYPICAL ANALYSES OF MISCELLANEOUS COMMODITIES USED IN FOUNDRY PRACTICE

By J. M. Quinn

(*Continued from Data Sheet No.* 548)

Commodity	Total Carbon C	Silica SiO_2	Ferrous Oxide Fe O	Ferric Oxide Fe_2O_3	Aluminum Al_2O_3	Calcium Oxide Ca O	Magnesium Oxide Mg O	Sulphur S	Loss	Manganese Oxide Mn O	Phosphoric Acid P_2O_5	Source of Data
MISCELLANEOUS MATERIALS												**MISCELLANEOUS MATERIALS**
Acid Elect. Furnace Bottom made from 80% Crushed Silica Brick, 6% Fire Clay, 14% Tar and Rammed in	7.75	80.50	1.16	0.38	3.08	4.30	1.91	.....	0.80	0.27	0.02	..... Weitlaner—The Blast Furnace & Steel Plant, January.....1922
Same Lining after 27 heats of steel	1.20	64.60	1.93	0.43	2.65	12.90	2.90	.....	.....	12.05	0.02	..... Weitlaner—The Blast Furnace & Steel Plant, January.....1922
Silica Brick Side Walls in Acid Elect. Fce.	.....	95.30	0.26	0.57	0.58	1.85	Trace	.....	.....	0.19	0.08	..... Weitlaner—The Blast Furnace & Steel Plant, January.....1922
Same Brick after 27 heats of Steel	.....	83.50	3.65	4.50	0.97	3.55	0.65	.....	.....	2.36	0.08	..... Weitlaner—The Blast Furnace & Steel Plant, January.....1922
Stalactites Formed By Melting of Silica Roof Brick in Basic Electric Furnace — Normal Brick	.....	95.17	.....	2.27		2.53	0 03	.....	.....	.....	.....	..... Hansen-American Electro Chemical Society, Vol. 19.....1911
— Base of Stalactite	.....	92.16	.....	3.68		2.79	0.49	.....	.....	.....	.....	..... Hansen-American Electro Chemical Society, Vol. 19.....1911
— Tip of Stalactite	.....	76.33	.....	3.88		9.74	7.94	.....	.....	.....	.....	..... Hansen-American Electro Chemical Society, Vol. 19.....1911
Condensed Fumes from Basic Elect. Furnace deposited on Electrodes during Oxidizing period	.....	4.50	8.49	60.60	.....	.....	8.10	Minor	Quantities of Other Substances.			Amberg-Metallurgical & Chemical Engineering, Vol. 10.....1912
Condensed Fumes from Volatilization of Ferro Silicon added on Slag with excess of Coke near Electrodes in Basic Electric Fce.—Blue Gray Powder	4.00	85.00	6.00	.....	.....	4.00	.....	.....	.....	.....	.....	..... U. S. High Speed Steel & Tool Corp., Green Island.....1920
Condensed Fumes from Volatilization of Silicon in Ferro-Silicon Electric Furnace—Blue Powder	16.38	67.69	4.11	.....	9.72	1.90	.20	.....	.....	.....	.....	..... Bureau of Mines, Bulletin 77, Washington.....1916
"Sonims" is Abbreviation for "Solid Nonmetallic Impurities".												
Sonim at base of shrinkage cavity in a 63-inch ingot of Basic OH Steel. Lower Part—Yellow Blue	.....	51.60	Trace	.....	7.88	.....	.....	.....	.....	40.60	.....	..... De Mare—*The Iron Age*, June 3.....1920
Upper Part—Violet Blue	.....	50.34	Trace	.....	18.90	.....	.....	.....	.....	29.94	.....	..... De Mare—*The Iron Age*, June 3.....1920
Sonim at base of shrinkage cavity at 2 ton Ingot of Basic OH Steel. Transparent, Colorless and contained Bubbles	.....	37.06	2.16	.....	26.00	1.53	.....	.....	.....	33.17	.....	..... Hibbard—*The Iron Age*, May 29.....1919
Sonim on side of Ingot of Acid Open Hearth Steel. Dark Green, Transparent	.....	56.38	6.78	.....	15.33	1.39	1.90	.....	.....	17.72	.....	..... Lindemuth—*The Iron Age*, May 29.....1919
Sonim on top of Ingot of Acid Open Hearth Steel. Bottle Green, Transparent	.....	49.35	4.75	.....	12.89	0.89	2.88	.....	.....	29.59	.....	..... Lindemuth—*The Iron Age*, May 29.....1919

(*Continued on Data Sheet No.* 551)

Do not cut—Fold along this line for binding

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Note—This sheet may be cut along this line and one half folded over on the other to bind in 5 x 7 inch note book.

THE FOUNDRY DATA SHEET, NOV. 15, 1924
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

THE PORTAGE SILICA COMPANY

SILICA MOLDING AND SAND BLAST SAND

602 STAMBAUGH BUILDING

J. G. BUTLER, JR., PRES. AND TREAS.
E. E. KLOOZ, VICE PRES. AND GEN. MGR.
J. B. CHAMBERS, VICE PRESIDENT
L. R. FARRELL, SECRETARY

ADDRESS ALL COMMUNICATIONS TO THE COMPANY

WORKS NEAR PHALANX, OHIO

PHONES
BELL, MAIN 684
AUTOMATIC 5226

YOUNGSTOWN, OHIO June 14, 1923.

The Foundry,
Cleveland, Ohio.

Attention: Mr. J. D. Pease, Director Advertising Sales

Gentlemen:

The recent American Foundrymen's Convention and Exhibition has strengthened our conviction of the value of advertising in The Foundry. It seems that everyone connected with the foundry trade, with whom we came in contact, was familiar with our operations and products. We attribute thiscondition to our continuous advertising in The Foundry.

When we started our advertising campaign in 1911, our product was just being placed on the market, and the steady growth has been in a large measure due to this campaign. We therefore can come to only one conclusion, and that is that The Foundry is the best medium to bring products such as ours to the attention of the consumer.

We also wish to emphasize our appreciation of the hearty co-operation which we have always received from your staff.

Yours sincerely,

THE PORTAGE SILICA CO.

E E Klooz

GENERAL MANAGER

EEK:F

Studebaker Opens New Shop

Detailed Practice in Connection with Making the Molds and Cores by Hand and on Various Types of Machines Is Presented Together with a Description of the Cleaning Room

BY PAT DWYER

COREMAKING methods and mixtures as practiced in the new foundry of the Studebaker Corp., in South Bend, Ind., do not differ to any material extent from those practiced in other foundries which specialize in automobile castings. Local Indiana sharp sand bonded with oil and prepared in a grinding pan is used as a core mixture. The cores are rammed in metal core-boxes machined accurately to size and where the shape justifies their use, the cores are dried in metal forms.

The coreroom occupies a space 160 x 320 feet in the center of the building directly in front of the cupolas and extending all the way across to the wall which separates the foundry from the cleaning room on the west. It is equipped with three batteries of oil fired ovens made by Holcroft & Co., Detroit. One battery of 12 ovens extending north and south is located on the opposite side of a 20-foot gangway from the cupolas. Each oven is provided with doors at both ends and the entire battery is employed for drying the large body cores. These cores are not loaded on racks in the ordinary manner and conveyed into the oven on lift trucks. The first tier of cores is carried into the oven one at a time and placed on a row of horizontal bars supported on suitable angle irons in the opposite walls. These bars are flattened at the ends and are not attached permanently to the supports. A second row of bars is placed above the first tier of cores and the second lot of cores is placed on these bars. In other words the man who loads the oven starts with an empty chamber and builds up his bars and cores as he goes along until the oven is filled to capacity. The method is illustrated in Fig. 6.

The remaining two batteries of ovens extending east and west are located about 100 feet from the first battery. Each battery is made up of 12 ovens arranged back to back in rows of six. A pair of oil burners in a chamber under the floor, connected with the tunnel system supplies the heat for each battery of ovens. The flame enters a long flue or firing chamber and the heat rises into the ovens through suitable openings in the brickwork which forms a false floor 24 inches below the steel floor plates on which the core racks are supported flush with the core room floor.

Suitable dampers are provided for the firing chamber openings, also for the openings leading to the stack. By manipulating these dampers the heat may be regulated in individual ovens to suit varying conditions. Similarly it may be shut off altogether, if for any reason an oven may not be required or may be out of commission temporarily. A suction fan mounted on the top of each battery supplements the natural draft and removes steam from the ovens in the early stage of drying. Each oven has accommodation for two core racks and the drying time averages 3 hours. Green cores supported on flat plates

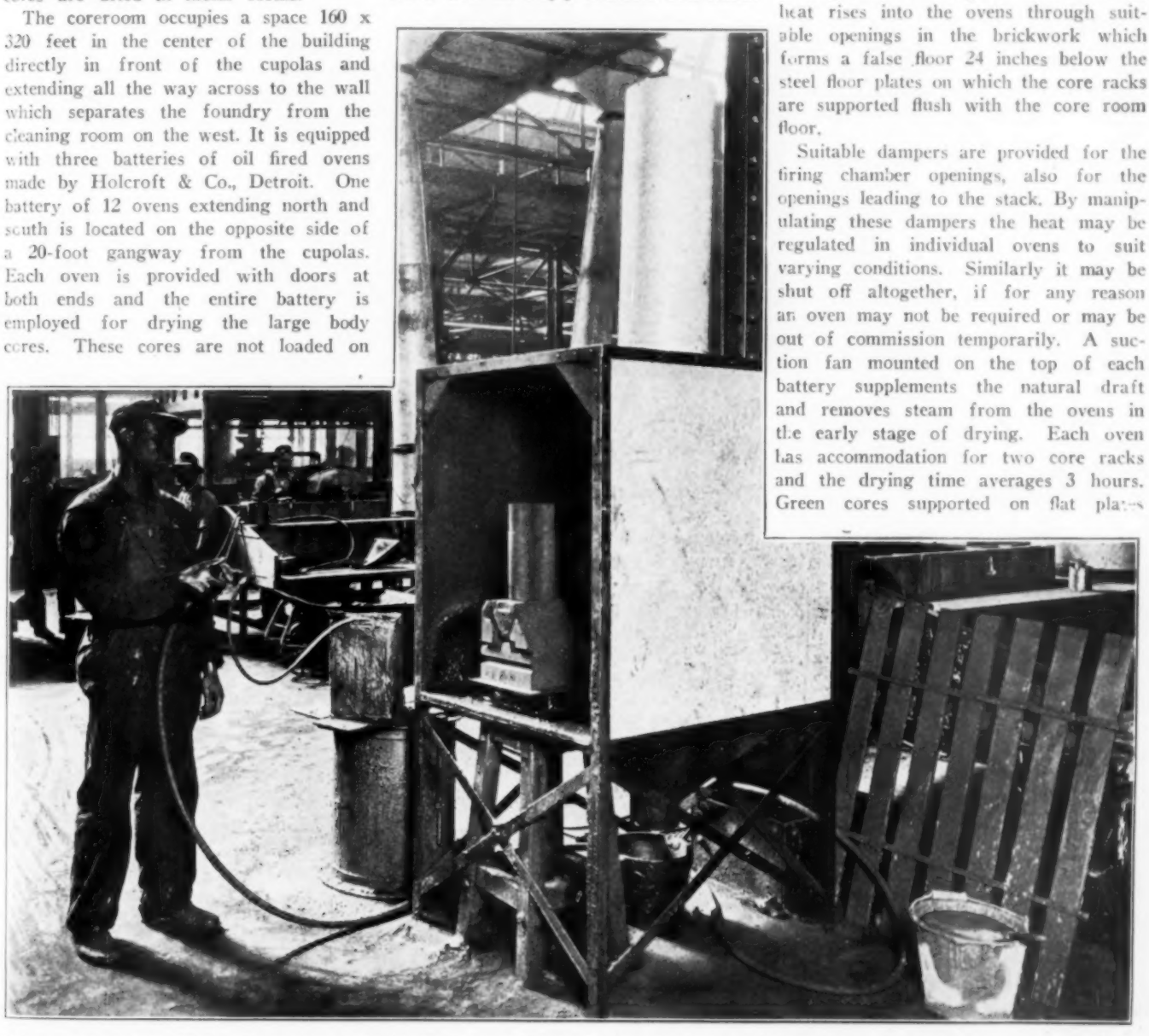

FIG. 5—EACH SECTION OF THE BODY CORE IS PLACED WHILE GREEN ON A REVOLVING STAND WHERE IT IS SPRAYED WITH BLACKING—SURPLUS BLACKING DRAINS THROUGH A SUITABLE OPENING IN THE BOTTOM OF THE CHAMBER

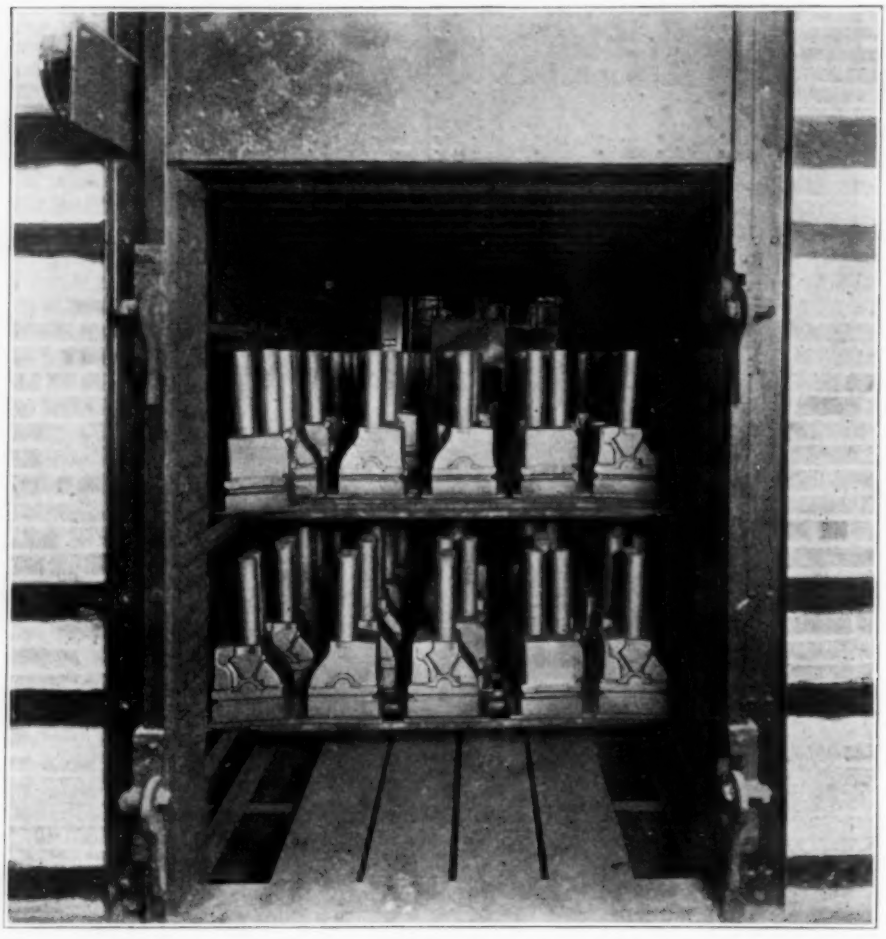

FIG. 6—THE BODY CORES ARE BUILT UP ON TEMPORARY RACKS MADE OF BARS FLATTENED AT THE ENDS AND SUPPORTED ON STEEL FRAMES ATTACHED TO THE WALLS

or on dryers are placed on a core rack standing close to the coremaker's bench. When the rack is filled it is picked up by a lift truck and conveyed to one of the ovens where it is placed on the floor. Occasionally it may be necessary to let the racks of green cores stand for some time because no oven is available, but usually the progress of the work is scheduled so closely that an oven is ready to receive every rack. Provision has been made for two additional batteries of ovens in the same vicinity, one to the north and one to the south.

After the cores are dried the racks are removed by electric lift truck and taken to either one of two bays adjoining the core room. Here they are inspected and transferred to other racks equipped with castors on the bottom of the four legs and with four hooks on the upper end of the same legs. The hooks provide a means for attaching a sling from one of the monorail hoists which conveys the loaded core rack to any desired point on the molding floor where the cores may be required

Little power equipment is employed in the coremaking department. Most of the small cores are made in individual coreboxes manipulated by hand. Octagonal core benches have been erected at various convenient points on the coreroom floor and take the place of the usual long benches. It is claimed this form of bench presents many advantages including the facility with which the sand is supplied through a central upright pipe terminating in a hopper at the upper end. The two batteries of ovens previously referred to constitute a natural dividing line or neutral zone between the territory occupied by the male and female coremakers.

The largest cylinder core, that is the combined crankcase and barrel core for a six-cylinder block is made in three sections with two barrels to a section. Three coreboxes are provided at each coremaking station, one for the right, one for the left and one for the center section. With the exception of a few features on the outer panel on the right and left core the three sections of the core substantially are alike. The box is made up of four panels accurately fitted and joined together in a suitable manner. The box is placed on a bench, barrel end down and the sand is shoveled in through the open end and rammed by hand around a length of 1-inch steel pipe that extends from the end of the barrel to the back of the crankcase. The piece of steel pipe is perforated and serves both as an arbor and a vent passage for the core. After the corebox has been rammed full of sand, a steel plate is fitted on the top and the box is inverted. The catches are released and the box is removed from the core one panel at a time. An attendant lifts the core to a revolving stand where it is sprayed with blacking and then placed in the oven in the manner described in a preceding paragraph.

A plaster-of-Paris, drag mold with projecting points reinforced with pieces of steel plate is located near the bench where these cores are placed after they are removed from the ovens. The cores are fitted in this mold which serves as a gage to determine their accuracy when assembled in groups of three. Occasionally it becomes necessary to file one or more of the cores slightly. The cores then are lifted out of the plaster mold and loaded on suitable carriers by which

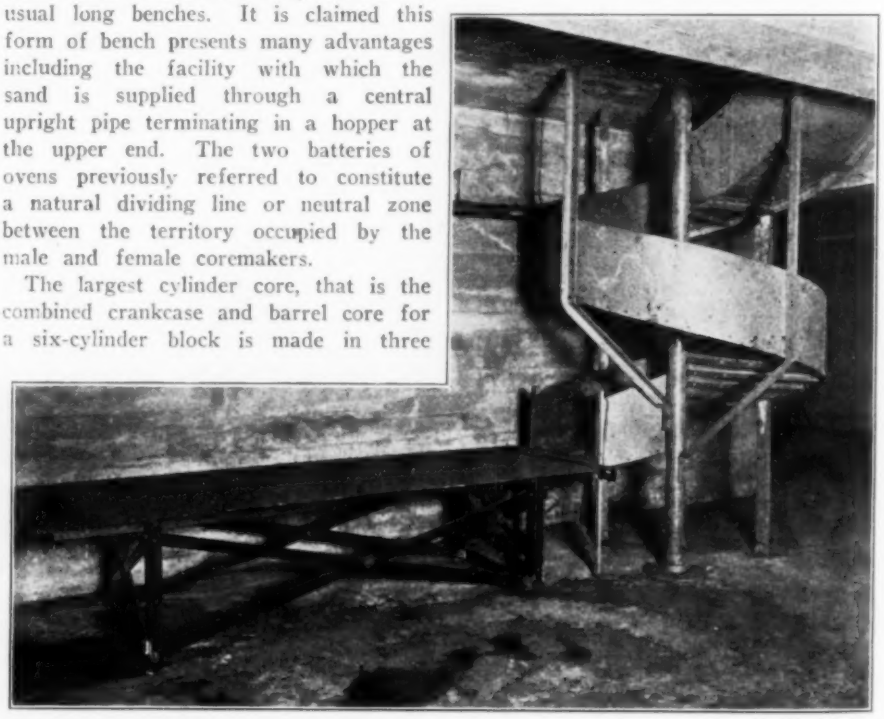

FIG. 7—A SPIRAL CHUTE PREVENTS DAMAGE TO THE CASTINGS ON THEIR JOURNEY FROM THE FOUNDRY FLOOR TO THE RECEIVING PLATFORM ON THE FLOOR OF THE TUNNEL

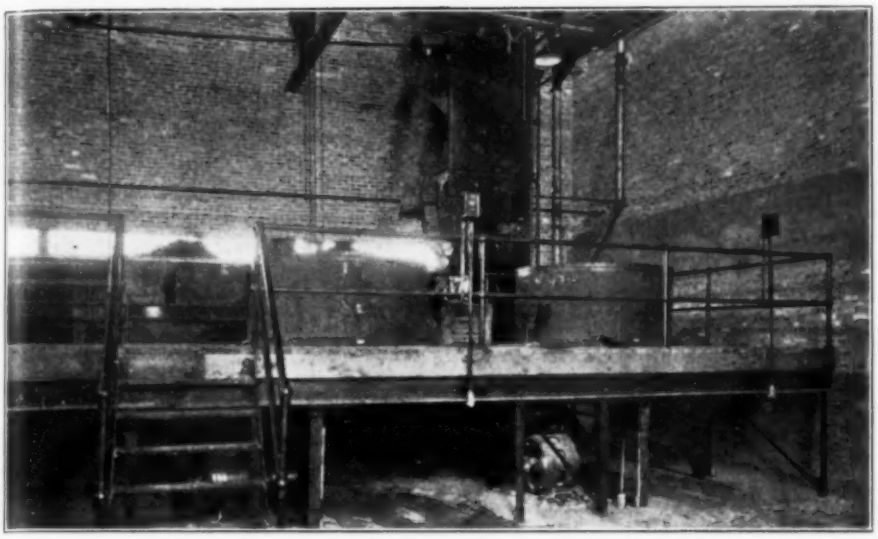

FIG. 8—A MEASURED BATCH OF CORE SAND IS LIFTED IN A BUCKET ELEVATOR AND DISCHARGED THROUGH A LONG PIPE INTO A REVOLVING MIXER

they are conveyed to the cylinder molding floors.

Cores for the manifolds are made as complete units in special boxes that include four parts. The fourth part simply serves as a dryer, but since it is essential to securing an accurate core, it seems only logical to include it as part of the corebox. The corebox proper is made in two parts jointed along a center line in the same manner as if the core were to be molded in halves and pasted. The part corresponding to the drag is placed on the table or bench and filled with sand, pressed down by hand. Reinforcing wires are pressed into place after which a false, cope half-box is adjusted in place. This half box has no back and therefore sand may be rammed through the opening. It is filled to the top and then removed. The actual cope half of the box then is placed in position over the drag half and rapped down thus forcing the sand into the proper shape. It is removed in turn and replaced by a dryer, an iron shell conforming to the shape of the core and provided with numerous vent holes. The dryer and drag half of the corebox are rolled over as a unit and then the half corebox is removed leaving the complete core in the dryer. The dryer and core are placed on one of the core racks where the dryer serves as a support while the core is going through the baking period. The drag corebox is returned to the bench and the operation is repeated.

These cores and many others employed in the manufacture of automobile engine castings illustrate in an interesting manner the difference in practice between an ordinary jobbing foundry and one that specializes in large quantities of duplicate castings. Under ordinary conditions the coremaker would ram the sand with a little butt rammer. He would place a row of fine coke or a wax vent in the center with a branch leading to each outlet. He would bend and cut his own wires and spend about half an hour over each core. In the specialty foundry the operator presses the sand lightly into the corebox with his hands. He uses neither coke, wax nor a vent wire, and he places a complete core on the rack in less than 1 minute.

FIG. 10—THE CORE OVENS ARE ARRANGED BACK TO BACK IN BATTERIES OF TWELVE, SIX TO A SIDE

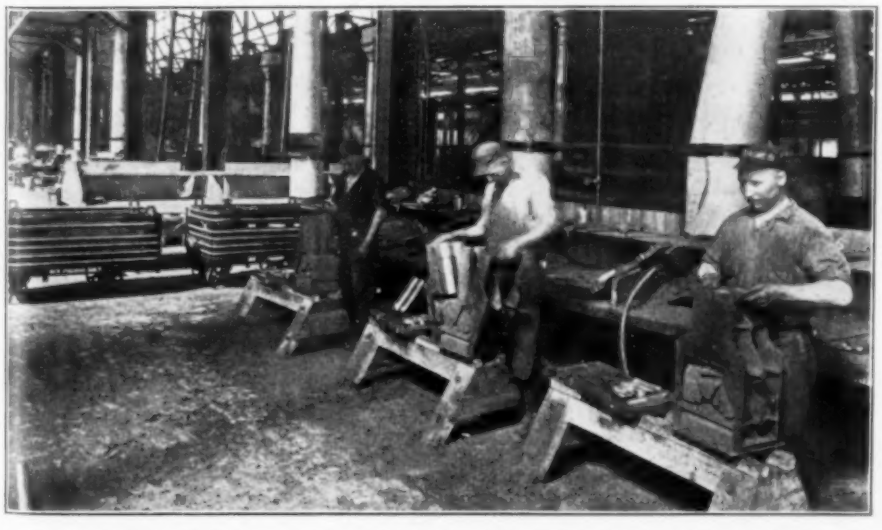

FIG. 9—BODY CORES ARE MADE IN THREE COREBOXES, ONE RIGHT, ONE LEFT AND ONE CENTER SECTION—EACH COREBOX IS IN FOUR PARTS

Pneumatic Core Machines

Cylinders for one type of car are cast separately from the crankcase and with the barrels in a vertical position. The barrel cores are made two at a time on a pneumatic machine supplied by Wm. Demmler & Bros., Kewanee, Ill. The machine is of the standard type, but is provided with a few special features to suit this particular job. Two split coreboxes are provided so that one may be filled with sand while the operator is removing the rammed core from the other. The box is placed in position vertically under the magazine where it is shot full of sand when the

operator pulls a lever. The remainder of the operation is automatic. The corebox is moved from under the magazine to a point a short distance away on the table where a ⅜-inch vent rod is forced through the center of the core from the top to the bottom. At this stage the clutch is thrown out and the vent rod is pulled up by a spring. The operator removes the corebox and replaces it with the empty box and the operation is repeated. The full box is laid on a bench, one half is removed and replaced with a dryer, then the combined half box and dryer are rolled over, the half box is removed and the dryer with the complete core is placed on the core rack. The machine is provided with a bucket elevator which keeps the magazine filled with prepared sand. Valve inlet cores and many other small cores are made on a pair of smaller machines supplied by the same company. They are plain machines without either elevator, shifting or venting mechanism. The girl attendant places a corebox under the magazine opening, presses a lever with her foot which releases an air valve; the sand is shot into the corebox, the girl removes the box to a core plate where the cores are deposited. The box then is returned to the machine and the operation is repeated indefinitely. The valve cores are made in a multiple box containing four core cavities. The magazine is filled with sand shoveled in by hand.

Rows of columns 47 feet, center to center, serve to divide the molding area into 10 bays 475 feet in length and located equally, that is to say to the extent of five bays, on each side of the core department. An additional bay, set apart for gaging and storing the cores, separates the molding area on each side from the core room. In like manner, a bay at the extreme end next the wall at each end is reserved for flask storage. It is provided with a 3-ton crane to facilitate piling the flasks and lifting them on and off the trucks.

Each molding bay has been set apart for the production of one definite line of casings and has been furnished with the necessary equipment for the purpose. In fact each bay may be regarded as a self contained unit or foundry in itself. The only feature it shares with the remaining units is that it draws its molten iron, its facing sand and its cores from a common source of supply. A branch from the monorail extends from one end to the other of each bay and a 1-ton, floor-controlled air hoist is provided in each bay where the larger flasks are used.

Patterns for the different castings are mounted on machines of various kinds and the methods employed in making the molds conform to those usually noted in automobile casting foundries. Minor points of difference are shown in connection with the molding of the light-six cylinder block minus the crankcase and the light-six cylinder block in which the crankcase is cast integral with the body.

The first is made in a three-part flask from three pattern parts mounted on machines made by the International Molding Machine Co., Chicago. The drag is rammed on a jolt-ram, rollover machine, the cheek is rammed by hand on a plain stripping plate machine and the cope is rammed by hand on a plain pattern plate that is neither stripped nor rolled over. The cope is lifted off the pattern plate and placed on the cheek of the partly assembled mold.

A covering core with suitable openings for the six barrel cores is located on a block on the cope plate. A second block the shape of the desired runner basin is placed on top of the covering core. The cope flask then is adjusted in place and the space not occupied by the covering core and the runner block is rammed full of green sand. The runner block is lifted out and the cope is lifted from the pattern plate and closed down over the long barrel cores projecting above the joint on the cheek flask.

The upper end of each barrel core is tapered and the opening in the covering core is tapered to correspond. Thus when the cope is lowered into place the covering core grips each barrel core and holds it firmly in place. The barrel cores project above the covering core

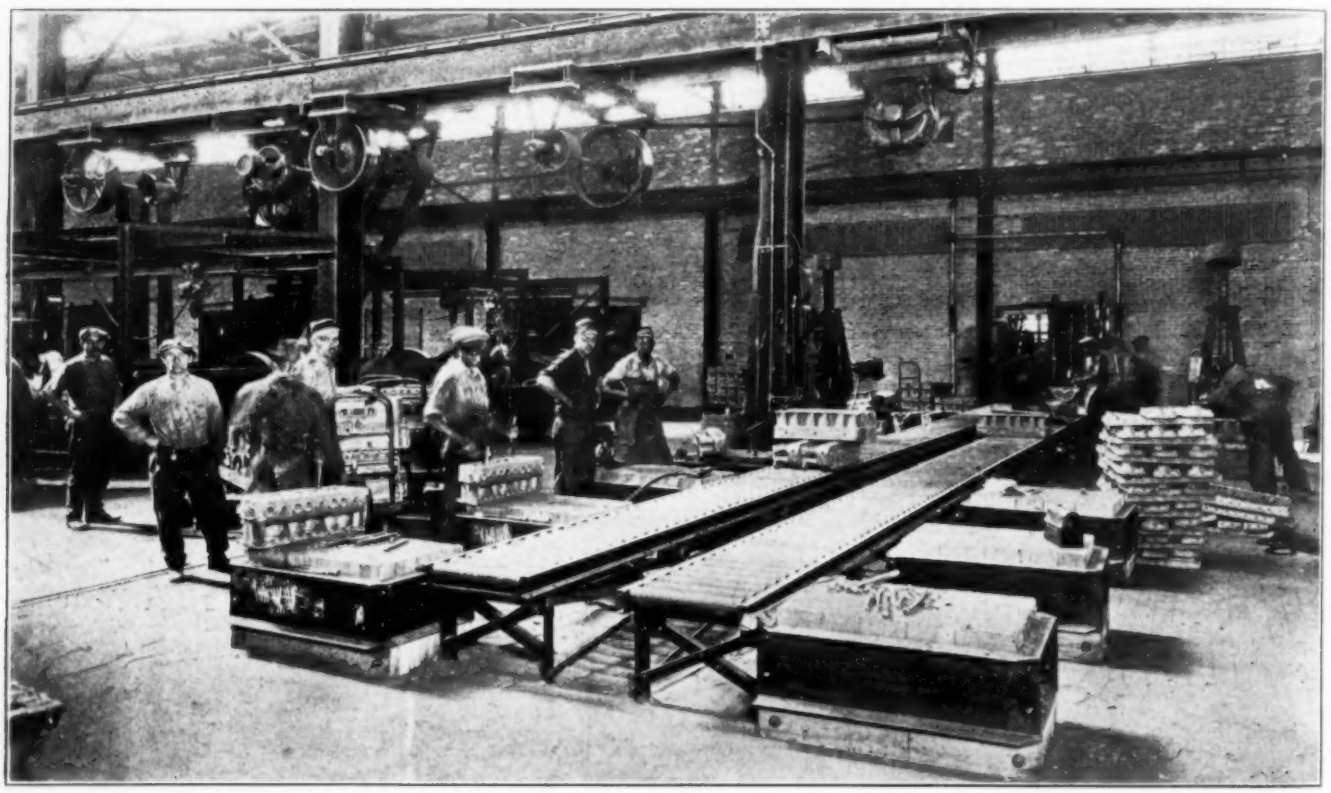

FIG. 11—ONE OF THE UNITS ON WHICH THE CYLINDER CASTINGS ARE CHIPPED. THE ROLLER CONVEYORS SERVE TO CARRY THE CASTINGS TOWARD THE ROUGH MACHINE SHOP

to a point that brings the top flush with the top of the runner basin. A cast-iron frame is clamped across the top of the flask. Small wedges are inserted between the frame and the tops of the barrel cores to prevent the cores from rising. A few small pieces of flat core on edge are wedged down in a similar manner to hold the covering core. These small flat cores also serve to reinforce the pouring basin. From the pouring basin the iron enters the mold through eight runners 3/16 x ½ inch spaced equidistantly around each barrel core. A narrow tin ring is dropped over the top of each barrel core and allowed to come to rest on the covering core in such a manner that it covers the ring of runners and prevents any dust from entering before the iron. The mold is poured from two ladles, one at each end and is filled rapidly. The ladles are of just sufficient capacity to pour the casting.

Poured From Bottom

Patterns for cylinder blocks with crankcase attached are split horizontally through the center line of the barrels and are molded in two-part flasks in green sand. From a pouring basin on the top, the iron drops to the bottom of the mold through suitable upright runners in the print of the crankcase. A long runner on the bottom side of the print is connected to the lower edge of the crankcase mold by a number of shallow gates. The cope half of the mold is made on a portable sand-slinging machine and the drag is made on a rollover jolt machine. Sand on the various molding floors is prepared by two of the largest size machines made by the American Foundry Equipment Co., New York.

After the cylinder molds are poured, the sand is shaken out on the floor and the castings in turn are placed on a special vibrating device which shakes the core sand out of the casting. The sand falls through an opening in the floor and is collected in a truck which carries it to the east tunnel outlet where it is lifted by a crane and dumped through an opening in the north or the south wall. The casting is dropped through a second opening in the floor and follows a spiral chute similar to that shown in Fig. 7, which deposits on a platform on the floor of one of the tunnels. From the platform it is loaded with others on a truck and hauled to the west end of the tunnel on to a hydraulic elevator. The elevator lifts the truck to the level of the cleaning room floor where the truck with its load of castings is taken to a battery of tumbling barrels.

Openings in the floor over the tunnels are provided a short distance apart in all the bays devoted to molding the castings. They are covered with suitable lids when not in use. The chutes leading from the various openings to the tunnel floor are of various types depending on the character of the castings made in the vicinity. The chute shown in Fig. 7 with many turns is designed to retard the speed of the heavier castings in their descent. Chutes for the smallest castings present a straight incline and discharge directly into trucks placed there for the purpose.

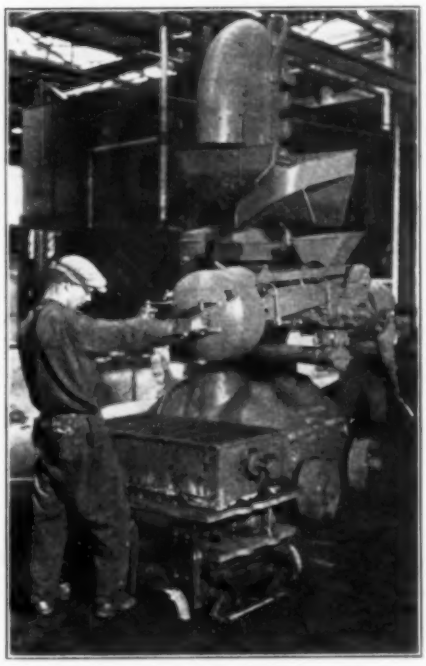

FIG. 12—ONE HALF THE CYLINDER PATTERN IS MOUNTED ON A PLAIN STRIPPING PLATE

A continuous type of tumbling barrel recently developed by the W. W. Sly Co., Cleveland has been installed for cleaning the gates and sprues and small miscellaneous scrap that accumulates on the foundry floor during the shaking out process. It is located in the tunnel with the receiving end under one of the openings in floor above. The material is dumped through the opening into the barrel which is set at a slight incline from the horizontal. By the time the scrap is discharged into a truck at the lower end it is thoroughly cleaned. It then is taken to the end of the tunnel and lifted by the crane to a point where it may be handled as a regular part of the cupola charge. The sand falls into a second truck and is disposed of with the other rubbish as described previously.

Describes Cleaning Room

The cleaning room, 80 x 660 feet, is separated from the remainder of the foundry on the west by a brick partition wall. Several doorways are provided in the wall for miscellaneous trucking, but the great bulk of material enters the cleaning room through the four tunnels which extend the full width of the foundry under the floor. A row of steel columns divides the cleaning room into two longitudinal sections and one of the sections is served by a 5-ton traveling crane.

Castings are cleaned in rectangular and cylindrical tumbling barrels set up in batteries of six to eight at various points on the floor. Each battery is independent of the others in that it has its own motor and is provided with an overhead steel frame from which is suspended either an air hoist or a chain block for handling the loads. Many of

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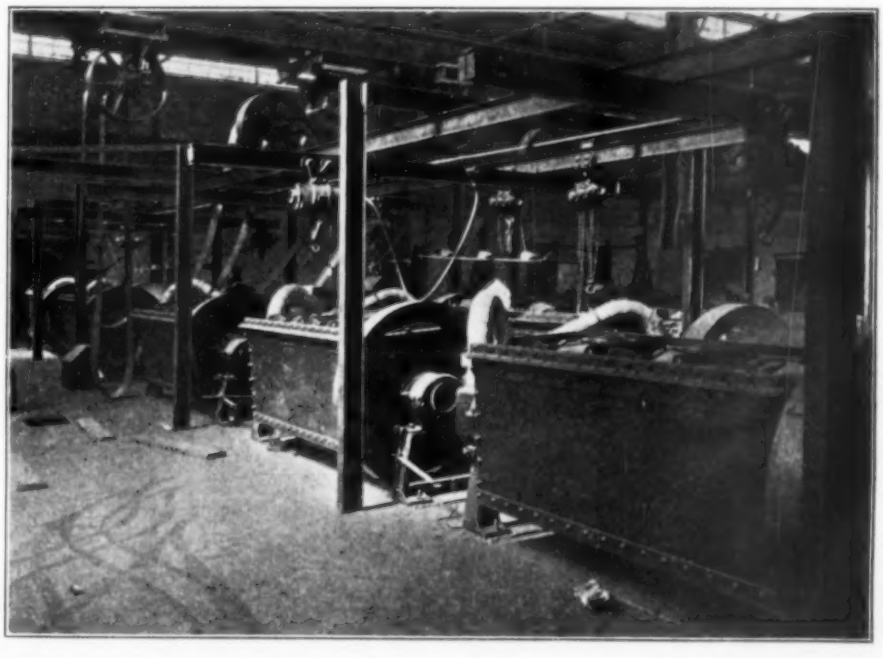


FIG. 13—ONE OF THE MANY BATTERIES OF TUMBLING BARRELS EQUIPPED WITH HOISTS AND PIPING LEADING TO A DUST ARRESTER

Sulphur As a Hardening Agent

Interesting Series of Experiments Carried Out To Determine Relative Hardening Value of Varying Amounts of Sulphur Added to Iron Which Later Was Poured Into Chill Molds

BY R. H. PALMER

EXPERIENCED foundrymen are familiar with the fact that while a high sulphur content is not desirable in the general run of gray iron castings, still, under certain circumstances it is not only desirable but necessary. This feature was illustrated recently in some wheels 16 inches diameter, 3 inch face, cast in a chill. The wheels were designed to travel back and forth a short distance and were not subject to shock. The wear was excessive and it was felt that an addition of sulphur to the iron would cause a deeper chill on the tread of the wheel. The iron mixture used at the time was uniform in character, suitable for pouring ordinary machinery castings and the number of wheels made per day did not warrant a special charge for pouring them. It was decided to tap this ordinary iron into a ladle and then add sulphur before pouring the iron into the wheel molds. Several interesting features in connection with iron poured under varying conditions are illustrated in the accompanying pages.

The down gate from a casting weighing 800 pounds is shown in the center Fig. 1. The casting to the left was poured into an iron mold regularly employed in taking tests from locomotive cylinder iron. The iron was poured at a high temperature. The casting at the right was poured in a similar chill mold from the same ladle of iron, but the iron was poured at a considerably lower temperature. Possibly the character of the fracture will not reproduce clearly on the printed page, but by examining the illustration closely it will be noted that the iron in the center shows a fairly open structure; the iron at the left is close grained, but not chilled; the iron at the right shows a white or chilled area at two corners.

Note Temperature of Iron

From the foregoing it is apparent that contrary to the theory some times advanced, iron does not chill as readily when poured hot as it does when poured cold. The hard outer skin or shell on a casting frequently is annealed and does not appear, due to the fact that the casting is left in the mold until it has cooled. A closer grain usually is obtained by pouring medium size castings with comparatively cool iron.

Test pieces from the regular mixture used for small castings are shown in Fig. 5. The iron was poured in one chill on one day and in the same chill on the following day so that the condition of the chill and other factors incident to the test should be the same when each test was prepared. The iron for these tests was treated by placing 6 drams of flowers of sulphur in the bottom of a ladle that had been heated but not used. About 100 pounds of iron was poured into this ladle and after it had been stirred thoroughly with a skimmer, the test was poured. In these tests it will be noted that the line of demarcation between the white and gray iron is sharply drawn. There is no neutral or mottled area such as usually is observed in chilled castings where the chilled area merges into the gray iron.

Conclusions Drawn

In former days when the foundry man drew his conclusions from the fracture, he experienced no difficulty in deciding whether the scrap car wheels used as part of his mixture had been made from coke or charcoal iron. Where the line of demarcation was defined sharply he knew that coke iron had been used in the wheels. Where a mottled area connected the white and the gray, he was certain that charcoal iron had been employed. In the early days of the car wheel industry, and probably to some extent even up to the present, the best wheels were made from a mixture in which charcoal iron figured prominently. The usual grades employed were 3 and 4.

A number of pieces from the rim of an old worn out car wheel apparently cast from a charcoal iron mixture are shown in Fig. 8. The gradual change in the grain formation from gray to white iron is quite apparent in the two lower pieces of scrap. Part of the down gate for a locomotive cylinder is shown at the left and the in-gate for the same casting is shown to the right in the illustration Fig. 4. The casting to which this gate was attached weighed about 4000 pounds.

Three interesting samples poured under varying conditions from the same ladle of iron are shown in Fig. 2. The sample at the left was poured in a green sand mold and shows a uniform grain structure on the fractured surface exposed. The sample in the center was poured in the chill mold provided for taking locomotive cylinder test bars. A chilled area approximately ½-inch deep appears on three sides. The third sample shown at the left was poured from iron that had been treated with sulphur in the ladle in the same manner and in the same proportion as was described in a preceding paragraph. The iron was poured in a green sand mold with one side formed by a flat plate that served for a chill. It will be noted that where the chilled part of the casting appears along the upper edge it is about one inch deep.

For the benefit of anyone who may wish to try this method of securing a deeper chill on iron, it may be well to point out that the amount of sulphur required to chill the iron to a definite depth will vary depending on whether it is placed in the bottom of the ladle before the iron is spilled into it or on top of the iron already in the ladle. In the first instance practically all the sulphur is absorbed by the metal. In the second instance a considerable portion of the sulphur is volatilized and in the condition it passes off into the atmosphere instead of combining with the iron.

Chill Tests Taken

Chill tests taken in connection with locomotive cylinders weighing from 5000 to 7200 pounds are shown in Figs. 3, 6 and 7. By comparing these with Fig. 5 the difference between a natural carbon chill and one produced by high sulphur is apparent. In the carbon chill shown in Figs. 3, 6 and 7 it will be noted that the gray iron merges gradually into the white, while in Fig. 5, where sulpher was employed to increase the chill, the line of demarcation between the white and the gray iron is distinctly evident to the eye.

FIG. 1—LEFT—POURED HOT INTO A CHILL CENTER-RUNNER TO A LOCOMOTIVE CYLINDER—RIGHT—POURED COLD IN A CHILL

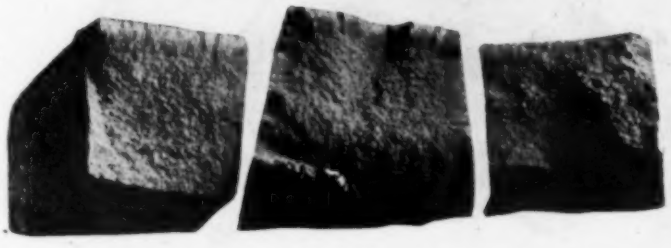


FIG. 2—IRON POURED UNDER SAME CONDITIONS BUT WITH SULPHUR ADDED TO SAMPLE AT LEFT

FIG. 3—CHILL TESTS FROM DIFFERENT CYLINDERS—NOTE UNIFORMITY OF STRUCTURE

FIG. 4—TYPICAL FRACTURE OF LOCOMOTIVE RUNNER AND GATE

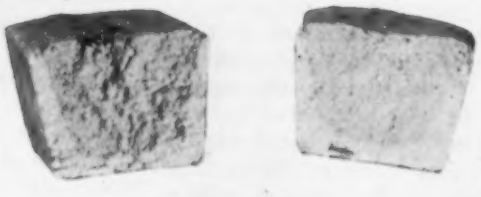


FIG. 5—CHILL INDUCED BY SULPHUR PLACED IN THE BOTTOM OF THE LADLE

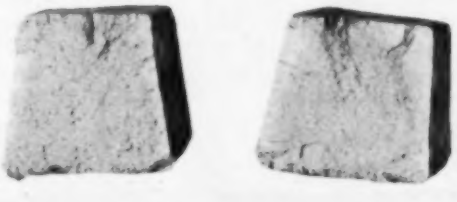


FIG. 6—CHILL TEST MADE UNDER ORDINARY CONDITIONS FROM LOCOMOTIVE CYLINDER IRON

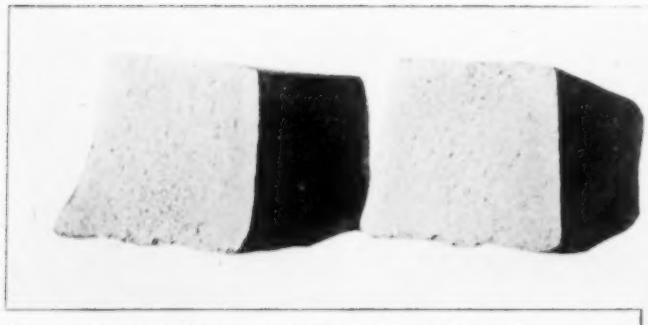


FIG. 7—LOCOMOTIVE CYLINDER TEST BARS SHOW MERGING OF WHITE AND GRAY

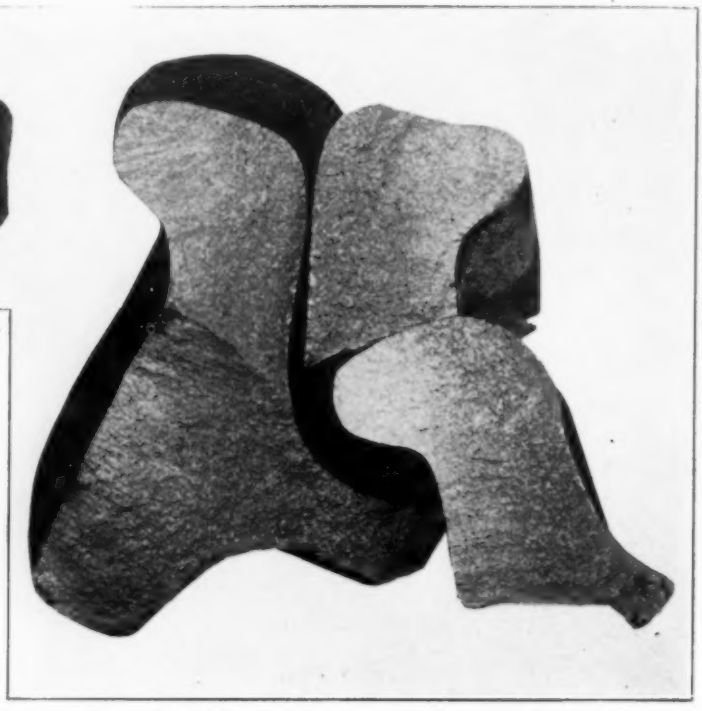


FIG 8—PIECES OF WORN OUT CAR WHEEL ILLUSTRATING THE SATISFACTORY MANNER IN WHICH THE TREAD IS CHILLED WITH CHARCOAL IRON

Transverse tests on the iron shown in Figs. 3, 6 and 7 range from 3500 to 3800 pounds with a deflection from 0.09 to 0.12 per cent. The sulphur in this iron was approximately 0.10 per cent and the silicon from 1.17 to 1.50 per cent. The carbon analysis for the tests shown is not available, but tests taken from similar iron in the past indicate combined carbon from 0.43 to 1.15 per cent, graphitic carbon 1.88 to 2.60 per cent. Test bars occasionally withstand a transverse pressure of 4200 pounds and a deflection of 0.12 per cent. The figures from a typical card for two test bars from locomotive cylinder iron cast without a chill follow:

STRENGTH AND DEFLECTION

No. 1 test bar	No. 2 test bar
Transverse 4000 pounds	4000 pounds
Deflection 0.12 per cent	0.12 Per Cent

ANALYSIS

	Per Cent	Per Cent
Phosphorus	0.408	0.414
Manganese	0.46	0.46
Sulphur	0.089	0.086
Silicon	1.75	1.73

Should Record All Cost Control Factors

By H. P. Keller

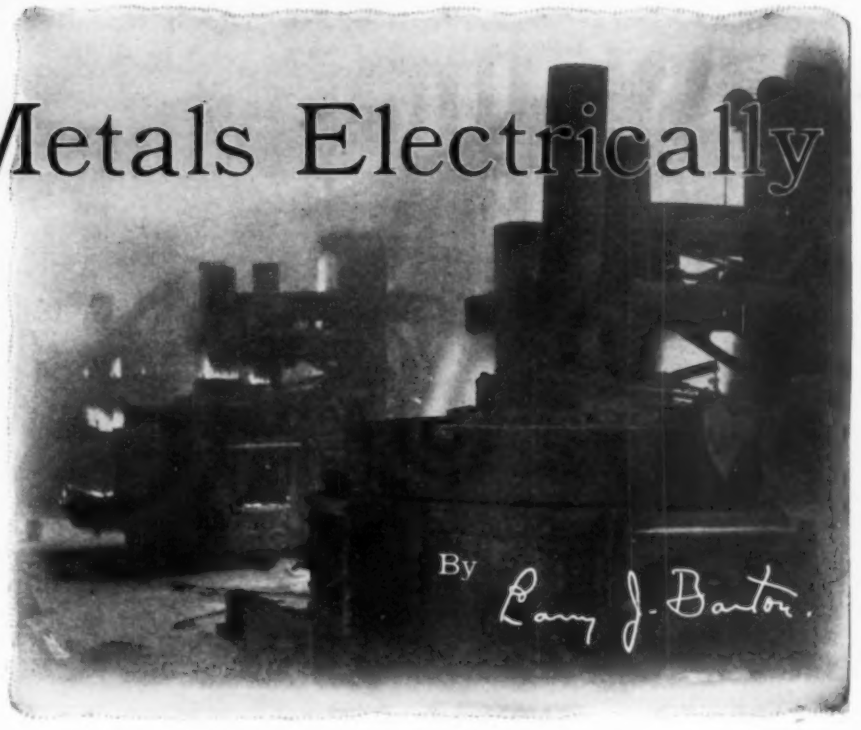
Experience has shown that some sort of records must be kept to operate a foundry with any measure of success. Man, as far back as we know, has found it necessary to record his thoughts and deeds by symbols. It is utterly impossible for any man to remember accurately all the details pertaining to the production of any article. Under modern conditions it is essential that strict record be kept of every phase of operation. Such record enables the foundryman to analyze his business closely and permits intelligent management. Wastes can be detected and prices properly fixed.

One of the foremost contributing causes to inefficiency in management is the improper distribution of expense burden. Many a dollar is lost and many a job goes to a competitor because of some phase of this condition.

To control this most important feature in modern industry, an interlinking shop order and stores requisition system usually is attempted but too often what to clerks seems to be minor details and red tape are neglected with the result that the full effectiveness of the plan is lost and an alarming number of articles used in the manufacture of patterns as well as castings find their way into a miscellaneous expense account. When costs finally are taken the jobs which should have been charged with these items of expense appear to have cost less. On the other hand, some jobs which according to accounting principles, should not be taxed for other work are heavily penalized. To anyone familiar with foundry practice it is evident how such a procedure defeats the purpose for which the system was installed. Should the figures obtained in this way be used for further quotation, the management soon will find that the prices quoted are sadly amiss and that some of the paying jobs have been lost by high price quotations. On the other hand the plant will have no difficulty in securing work which showed up at an advantage as a result of the improper distributing of charges. Unless the management is alive to this situation it is easy to see what the ultimate outcome will be. Many a foundry has found itself in straightened circumstances much to its surprise and still had large orders on the books. However the awakening came too late. The time to check costs and accuracy of systems is now. Make every job stand on its own feet and with that motto in mind and in practice you cannot go far wrong.

As self satisfaction and pride in ones own achievment is one of the weaknesses of human beings it can be assumed safely that the process of looking the facts in the face will in some cases be more or less slipshod. Mr. Smith who has operated a foundry for a number of years with a measure of success will pause for a moment to reflect on his own improvised methods and with convitcion will state that he sees no means by which his foundry system can be improved. However, this comment is not meant for the foundryman of narrow-gage type. The modern foundryman has had his eyes opened by cost comparisons which at one time or another were quite startling. Immediately his ideas of costs were revised and in his opinion anything but an intelligent system for accurate cost finding which permits of periodical compansions is absurd and a waste of time and money. Not only is the equitable distribution of material and labor charges important, but how about the overheads. Do you dump all your overheads into one bulk account and distribute on a tonnage or poundage basis? Some will say—"Certainly, why not." What is the effect on the cost of either light or chunk castings? You will agree that a fair method of overhead distribution should place the burden where it belongs.

Refining Metals Electrically



Chapter III (Continued)
Determining Final Pouring Temperature — Making Ladle Additions

PROPER pouring temperature for a heat of casting steel is one of the most important features in electric furnace operation. In the commercial shop, operating a 3-ton furnace, a wide variation will be noted during a week's run. On one heat, for instance, two or three castings will take the entire output, while on the following heat 3 tons of metal may pour 50 flasks. Consequently there are innumerable combinations, each requiring metal of a different temperature.

Naturally the metal must be sufficiently hot to enable it to run whatever class of casting is being made; it must be hot enough to pour the entire heat without sculling the ladle. Conversely, it must not be too hot as this implies a waste of power, and results in so scabbing and burning a casting that the time necessary for cleaning is unduly prolonged. While it is perfectly true that metal poured cold is of a better quality than that poured at higher temperatures, the point must be considered that in a foundry all operations must be carried on at the most economical basis, consistent with specified quality.

The proper temperature at which to pour a certain heat is a strict matter of experience, and due to the many variations, there can be no rule set for this operation. However, many different methods are in use at the present time for determining comparisons in temperature. Roughly speaking they may be classed under four main headings; The rod test, the skin test, the pour test, and the use of mechanical instruments or pyrometers.

The skin test consists of withdrawing a spoon full of metal from the furnace, and noting the time, by watch, taken for the metal to skin over with the oxide scum, denoting the beginning of solidification. The test time for ordinary work, usually is 30 seconds, anything less denoting cold metal, while above this time is an indication of hot steel.

The rod test is made by inserting a rod into the steel for a specified time, and withdrawing it quickly. The manner in which the point of the bar is burned denotes the temperature. If the rod is cut off short, the metal is hot; if cut off tapering the metal is medium, while if the rod is uncut or sculled the metal is cold. The rod must be left in the metal the same number of seconds for each test, and must be of the same size, or results will not show a true comparison.

The pour test is made by taking a spoon of metal, skimming off the slag, and noting with the eye the manner in which the steel pours over the lip of the spoon, and the time necessary for this metal to solidify in a chill mold. The degree of coldness can be judged by the scull left in the spoon, metal which is fairly hot pouring clean. Experience will show how much superheating is necessary above the point of a clean pour. This test gives as good, if not better results than the others. A few trials soon will show the melter how his metal is running, and he can assume safely that the metal will pour from the ladle in the same manner it poured from the spoon.

All of these tests are at the most only poor measurements of the actual temperature of the steel, as so many different points may change the result. The condition of the slag, the initial heat of the spoon before the metal is dipped, the amount of slag covering on the spoon, and the surface of the spoons contents, the position from which the test is taken, etc., all are changing conditions which interfere with the accuracy of the tests. It may be said that the tests always should be taken in exactly the same manner to be in any degree reliable. Certain conditions such as the following should be followed closely to observe standard results:

A cold, or nearly so, spoon should always be used.

It should be well rotated in the slag before dipping.

The test always should be taken from as close to the exact center of the furnace between the three electrodes, as it is possible.

The slag should be skimmed off as soon as the spoon is withdrawn from the furnace.

More accurate tests such as those made with pyrometers have not been accepted by the entire electric furnace fraternity for several reasons. Couple pyrometers require constant checking, and adjustment and may be off when needed. Further it is difficult to obtain any kind of a couple to stand the high heats of the furnace. Optical pyrometers are difficult to use, due to the inability to obtain proper *black body* conditions, but have been used for experiments directed upon the stream as poured from the furnace and ladles. However, as this is too late, if the temperature is wrong, it is generally

Final Treatment

WHEN a heat of steel in an electric furnace approaches completion, considerable skill and judgment is necessary to assure success. The determination of pouring temperature, a factor which is coming to be more strongly stressed, often must be made without the aid of measuring instruments. The author, in the accompanying article outlines the three standard trial methods for determining the temperature of metal in the furnace. The need for adequate instruments to measure this temperature in steel is stressed.Ladle additions to secure definite final analyses are deprecated for basic electric furnace practice. In the forthcoming article, Mr. Barton will discuss modifications of electric furnace practice which are encountered.

of little use. All this extra equipment, and the proper care of same over a period of time, costs money.

Checking temperatures in steel making is rapidly beginning to assume importance, as it is recognized that the heat of the metal is a point of the greatest consideration if the highest results are to be obtained regularly. Experiments are being carried on daily with this idea in mind, and it is reasonable to assume that someone shortly will bring forth some simple instrument which actually will work under the changing conditions of the electric furnace.

Completing the Heat

The metal being solid, and hot enough to fill the necessary requirements, it is now the proper time to begin to adjust the metal to fill its specifications. If any more manganese is required it is added, as is the remainder of the silicon, and after about five minutes the heat may be tapped. This is the most simple case, but is one which is seldom found in regular operations, the carbon usually requiring some slight adjustment before the pour.

If the shop has a chemist, a sample should be sent to him as soon as the first solid test is made. It will take approximately 15 minutes to run a carbon and a manganese, and during this time the metal is being brought to the finishing temperature. From his analysis the required amounts of any further additions may be calculated, and the materials laid out. It can be assumed safely that the silicon content will be about 0.15 per cent on the first solid test, and any further additions of this alloy can be made on this basis, allowing about 10 per cent for loss. Manganese may be figured straight, the loss of this element being negligible. In the bringing the carbon up many methods are in vogue. Pig iron may be used; coke, coal, or other carbonaceous material can be added and well rabbled through the slag; the electrodes can be dipped into the metal, and carbon taken from them.

For heats where close analysis is required, pig iron will give by far the best results, a low phosphorus, low sulphur iron being used, and given time thoroughly to assimilate in the steel bath. Coke or coal, if thrown directly under the electrodes will generally enter the bath, figuring about 50 per cent effective. The use of electrodes is not favored due to the cost, and to the many variables changing the amount dissolved. Regardless of the method used, a final test always should be taken, and the carbon judged either by fracture or analysis. As soon as the metal is ready the ladle is called, and the heat poured.

If a heat of steel is poured without some device being used to hold the slag back, the metal and slag when entering the ladle will be churned together, and the usual result will be that particles of slag will become trapped in the steel, later coming to light as inclusions in a finished casting, often resulting in its loss. These inclusions are not always visible. Steel may contain non-metallic inclusions even though they be too small to notice with the eye. These often cause castings to crack. They are a great aid to forming centers of segregation; and seriously interfere if the castings are to be heat treated.

Table XXX

Changes Made by Ladle Additions

Heat No.	Test	Carbon	Silicon	Phosphorus	Sulphur	Manganese
A	Ladle test	0.43	0.16	0.030	0.035	0.60
A	Bot. ladle	0.51	0.12	0.045	0.039	0.60
B	Ladle test	0.42	0.12	0.039	0.037	0.60
B	Bot. ladle	0.48	0.11	0.056	0.042	0.58
C	Ladle test	0.45	0.13	0.022	0.031	0.73
C	Bot. ladle	0.59	0.13	0.047	0.042	0.76
D	Ladle test	0.44	0.14	0.020	0.029	0.72
D	Bot. ladle	0.53	0.12	0.042	0.035	0.72

Naturally, some method must be used to hold back the slag until the metal is in the ladle. The best of these is the skim gate, which is made by building a box like affair on the spout, with a small opening near the bottom of the front side. The furnace is quickly tilted, the slag pours up over this opening, and the steel underneath runs into the ladle from this aperture. As soon as the steel is out, the slag will then run forth to form its covering for the ladle. Another method often used is to throw enough lime into the furnace in front of the spout to thicken the slag at this point. This holds back the body of the slag until the furnace is nearly free of steel, when this thick barrier can be pulled loose with a hook allowing the slag to pour forth.

The writer has found in pouring basic steel that if about 1 pound of finely crushed fluorspar per ton of metal, is thrown into the stream of steel, during pouring, it greatly aids in bringing up any entrapped slag, by combining with it and so lowering its melting point, and viscosity, that it quickly rises to the surface.

Adding Alloys to the Ladle

Many shops, operating the basic furnace, make a practice of adding their final silicon as well as their final carbon in the ladle. Often a small amount of manganese also is added. The writer is a firm believer in making steel in the furnace especially on basic operation where all points favor such a practice. Coke added to the ladle never is effective, and its degree of absorption only can be guessed by the roughest of estimates. Other means of raising the carbon such as graphite flakes on the ladle bottom, carburite, anthracite coal, etc., similarly are to be avoided as results under such circumstances will be irregular at the best.

Manganese added in the ladle cannot have the necessary time thoroughly to mix with the metal before being poured. This results in hard spots in the castings, and heavy segregation. This is especially true of heats poured at a low, or medium temperature, and has been proved many times by closely checked experiments. In one particular instance, a heat of steel was poured into several nests of ingots for rolling purposes. Practically all rolled fine with the exception of three or four which were so brittle that they broke when dropped on the mill floor. Analysis showed slightly over 4 per cent manganese in these faulty bars. While this is an extreme case it only goes to drive home the lengths to which such segregations may go.

The addition of ferrosilicon to the ladle is widely practiced, but has no points which would recommend it. In the first place, its addition will only dope up the heat. There is the same chance of improper mixing, and the greatest disadvantage is in its tendency to go into the slag to form an acid condition. The effect of such an acid slag condition will be to cause a heavy sulphur increase as the pouring progress, due to the inability of the slag to hold its sulphur content. As all basic slags tend to go acid as the pouring progresses, due to the severe slagging action of this heavy lime slag on the acid ladle brick, this further acidity caused by silicon only enhances such action.

Discourages Ladle Additions

Some analyses illustrative of this point are given by Henry William Seldom in the *Blast Furnace and Steel Plant* of September, 1921. These are shown in Table XXX.

These tests, while made on the open hearth furnace, are extremely good illus-

trations of the course of different heats when ladle additions are made. In electric furnace work the change in the phosphorus content would not be so noticeable, but it is probable that there would be a much greater change in the sulphurs, due to the greater amount carried under the electric furnace slag conditions.

Final Deoxidizers

During the past ten years there have been a large number of patented final deoxidizing compounds placed on the market, their avowed purpose being to eliminate the last trace of gas from the metal. They have been composed of every conceivable metal, but in the main have been metals with a high affinity for oxygen, such as manganese, silicon, calcium, magnesium, and aluminum. The latter has been in use for many years, and still is used widely. Most of the patent alloys have been discarded, leaving the field to two main metals, aluminum and ferro-titanium, or as it is called ferro-carbon-titanium. While aluminum has an intense action in eliminating gases from steel, and promoting solidity, it has several great disadvantages. Properly made electric furnace steel does not require the use of any such expedient to make it sound. The use of aluminum greatly increases the shrinkage and is likely to cause trouble in the casting from this reason. Further the product of the combination of aluminum with oxygen is the solid alumina, which may remain in the steel as non-metallic inclusion, and later may prove to be the starting point for a defective casting. Therefore its use is adding an undue cost to the foundry, and is tending to lower the quality of the metal produced. In extreme cases, its use is mandatory, such as where a heat starts to go wild in the ladle, or when furnace trouble causes a heat to be tapped to save the furnace bottom.

However, titanium is a different proposition and its use is to be recommended. There are countless shops over the country who are making wonderful steel without the use of titanium, and there are others who make regular use of this alloy. Its use however and whenever used will always increase the quality of the steel, and it can be considered as a help with no disadvantages outside of its increased cost. This metal, titanium, in addition to its affinity for oxygen, has a strong affinity for nitrogen, and it is probable that a great deal of its value lies in the elimination of this gas from the metal. In combination it tends to form the nitride, or the oxide, both of which have low melting points and rapidly clear themselves from the steel by rising and entering the slag.

Both of the above should be added to the ladle after all the other alloys have been allowed to expend their deoxidizing power. The best manner to add these final alloys is in small sized pieces thrown in the furnace spout as the metal is running out. The metal carries them with it and as they melt they are thoroughly mixed by the churning of the steel.

As soon as the steel is in the ladle, and the slag begins to flow, several large scoops of lime are thrown in and mixed with this slag. This tends to thicken the slag and so lower its viscosity that it will, only with difficulty, combine with the brick lining. In addition, it furnishes an extra amount of a strongly basic material sufficient to overcome any slight tendency of the slag going acid through any such slagging action. This lime causing the slag to harden and thicken, has another advantage in that it tends to form a heated roof to the ladle, and saves a large amount of heat in this manner.

When all of the slag has entered the ladle heavy covering of ground coke is added to prevent any oxygen from the air combining with the slag and tending to turn it back into an oxidizing condition, and causing the heat to go wild as pouring proceeds.

Faked Foundry Facts

A Slow Draw

Making Bottom For a Conducting Hearth

To the Editors:

In Mr. Barton's article in Aug. 1 issue he covers the bottom installation on non-conducting, basic and acid hearth furnaces but he says nothing about conducting hearth type furnaces. He is right in that burned in bottoms are the better, but in the conducting hearth type furnace this is not possible because the bottom must be laid so as to be a good electrical conductor. This is accomplished by mixing steel slugs or punchings thoroughly with the batches before ramming them in. No bricks are set on the bottom plate, but the entire depth of bottom is rammed. It all depends how much one can spend on the bottom whether pure magnesite or the mixture of magnesite and a dolomite product is employed. The latter may be run to a high percentage if a cheaper bottom is desired, but straight magnesite gives the best results. Copper is a good conductor, while graphite is not quite so good. Then follow amorphus carbon, and steel punchings used to carry the current. The conductivity gradually diminishes from the copper plate to the hearth proper. The reduced conductance gives rise to greater resistance to the passage of current and the current is dissipated in heat which adds itself to the bottom of the charge. The bottom also is a fairly good conductor so that a contact is made between the third phase hooked on the bottom at the copper plate and the other two phases hooked to the two electrodes. If a bottom of this nature were burned in, all the steel in the bottom mixture would melt and run to the lowest point, the center. There would be increased conductance at the center and increased resistance at the other points of the bottom so that all the current would pinch at the center and overheat that point. Were a bottom laid thus heating would be irregular.

The batches for ramming must be heated separately before mixing. The magnesite and dolomite product are preheated on a steel plate under which is a wood fire and the steel and basic slag are added and stirred in. The dry batch should be heated so that one cannot place the palm of his hand on the batch for more than the fraction of a second. The pitch is heated in a tar boiler and poured onto the dry batch and mixed thoroughly until the batch shows a little moistness from it. Batches must be made small, about 10 shovels full at a time and ramming must be done immediately while the batch is still hot. This is best done with air rammers. It takes some practice to tell whether the batch has the right amount of pitch. If it is too wet it will not ram and if it is too dry it will not ram and if it is too cold it will not ram.

Al. Bryant, Pittsburgh, Pa.

How and Why in Brass Founding

By Charles Vickers

Metal Found Too Hot

We are having difficulty making aluminum wheels about 18 inches diameter, thin of section and having a comparatively heavy center. The castings crack at the gates, two of which are used at diametrically opposite points on the circumference of the wheel. The alloy is No. 12, and it is poured at 1300 degrees Fahr. The molds are of green sand in snap flasks. The molds are soft rammed, then squeezed on an ordinary air squeezer. Hand ladles are used to pour and the metal is fluxed with zinc chloride. We have made many experiments but with little success.

The trouble all centers in hot pouring, 1300 degrees being too hot. If good castings are wanted, fewer molds will be obtained for a day's work because more work must be put on each mold. One thing is certain the castings cannot be made by gating on the rim as at present, but if they are placed in a circle around the hub, the casting may be run with cooler metal. The castings may be made using drop gates the size of a lead pencil which may be arranged on the flat side in a circle, one to each spoke. These little sprues must be connected by a runner channel, which is cut on the exposed side of the cope, and the runner and all the gates have to be covered by a flat second cope which carries the sprue. The castings may be poured one up at 1250 degrees Fahr., they also may be molted with the deep side upward, the drop gates taking the shape of a thin wedge, one placed on each of the curved extensions. All this appears complicated but in reality it is not, it being a question of a little engenuity in getting up the "rigging." Gating on the rim is not feasible because the metal must be poured so hot defects are bound to occur, then the shrinkage of the large gates and sprues tears the rim of the casting apart.

To Make Own Bearings in South Africa

As our blast furnaces and rolling mills are located in South Africa where we have to be as self-contained as possible it is necessary to cast our own bearings and other brasswork. Our raw material consists of scrap metal of unknown composition, but chiefly of bearing kinds. The copper will consist of scrap wire from electrical apparatus. We desire to learn about how much copper it will be necessary to use to bring the scrap back to a good quality metal; also (1) what effect has tin when added to a melt of copper? (2) What is the effect of zinc? (3) What is the effect of lead?

As the composition of the scrap metal is unknown any addition of copper, tin, lead or zinc, that may be made thereto is nothing but guesswork and leads nowhere. In fact, the scrap, as a bearing material, may be injured by such addition instead of being improved. Such additions have to be made intelligently to get the best results. In the course of time a departmental brass foundry such as this one, will have processed all the foreign scrap metals, and its own product will be coming back to the foundry.

If a haphazard start is made, the domestic scrap may be much worse than the original outside scrap. Therefore, it will pay to go to considerable trouble with attendant expense at the start, in order that when this recast material comes back to the foundry, its composition will be on record. New metal then may be added as desired and the original alloy will be maintained without change. To work in this intelligent manner, it is necessary to have analyses made. All rolling mills and blast furnaces maintain a chemical staff, therefore, it should be easy to learn the composition of the brass.

At first all scrap metal should be melted and ingoted. Drillings then are analysed, and from this analysis additions of new metal can be made to maintain the analysis, provided such composition has given good service. It may be necessary to take a number of analyses especially if the scrap has been melted in small crucibles, but each analysis can be treated separately should there be any wide difference in composition. For bearings a good alloy to figure to is copper 75 per cent; tin 10 per cent, and lead 15 per cent. A little zinc is likely to show in the analysis, but this will do no harm, and should be figured off the copper. A good proportion to use is half scrap and half new metal. For castings other than bearings work to a formula such as copper 85 per cent; tin 5 per cent; zinc 5 per cent, and lead 5 per cent. When castings of this alloy return as scrap they are easily identified as they are not bearings. In melting, charge all the brass and copper at one time into the crucible. Never put in part of the charge and await its melting before adding more metal as this is a slovenly way of working and brings porosity and other troubles in its wake. The crucible will not contain all the charge before it melts, but it can be made to do so, by simply cutting off the bottom of the old crucibles with a hatchet, and using the bilge part as a deepener or hopper. This is set on top of the coked-up crucible, and has no coke around it.

The cover of the furnace should be dome-shaped, then should the deepener rise above the top of the furnace, the cover can be wheeled over it and will set down. Into the crucible put some charcoal, and melt. When the furnace has attained its heat, roll the cover a little and poke down any hanging metal; if the copper wire is hammered together, it can be put about midway of the charge with brass below and on top, then it will melt with little oxidation. A little phosphorus added just before pouring will improve the metal. Tin added to copper makes bronze, the more tin the harder the alloy. Zinc added to copper makes brass, also small amounts of zinc act as deoxidizers and promote solidity. Lead makes the alloy machine easily. It is used in considerable amount in bearing alloys as it improves the castings from an antifrictional standpoint.

Metal Polishes To Color of Nickel Plate

We are looking for a formula suitable for castings that will polish to the color and brightness of nickel plating. Will nickel silver do this? By adding such a large quantity of nickel to the mixture will it increase the cost of machining?

What is known as 18 per cent nickel silver has a color close to nickel. It consists of copper, 62 per cent; nickel, 18 per cent; zinc, 20 per cent. No lead being present the alloy will be difficult to machine and costs more than a leaded brass. Perhaps the following alloy would be more suitable for the purpose outlined. Copper, 55 per cent; nickel, 15 per cent; zinc, 18 per cent; lead, 10 per cent; tin, 2 per cent. This alloy is white and machines easily, but like all alloys care must be exercised in meeting it.

Bill Talks on the Value of Advertising

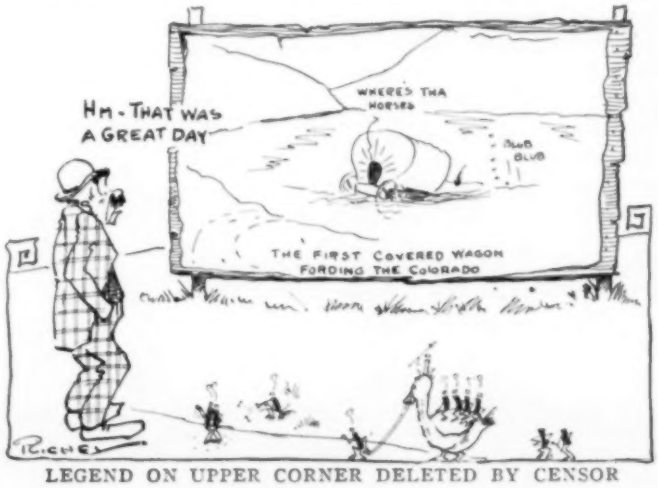
BY PAT DWYER

SOME time in the future, when I have an opportunity to look into the subject properly, I intend to do some intensive investigating into the highways and byways of the advertising business with a view to adopting it as a profession. This noble resolution is due to a prospectus I received through the mails today, free and without any solicitation on my part. A postal card was inclosed in the brochure with a printed address thereon which I was implored to return immediately if I wished to avail myself of further interesting information dealing with the promising field which the advertising business presented to ambitious men or women who are in a rut, but who know in their own hearts that they are qualified for a higher sphere of action. I was assured earnestly that the mailing of the post card involved absolutely no obligation on my part, but the writer intimated gently that if I failed to return the card I would live bitterly to regret an opportunity that only was presented to a limited number. The school had been established by a man with only an ordinary education, but who in spite of this handicap had become one of the most successful in the advertising field. He now had retired from active participation and had decided from purely philanthropic motives to devote the remainder of his life to instructing other ambitious members of the human race how to achieve success in this chosen calling. The dope—if I may be pardoned for referring to the burning message in this informal manner—rather appealed to me. Many times I have admired and envied the skill displayed by the writers of advertisements and occasionally have wondered in an idle way where, how and in what manner they had acquired their technique. In my youth I wasted many precious hours watching artists painting colossal signs on fences and on the ends and roofs of barns, informing unfortunate individuals that all their aches and pains would vanish before a few swills of Bimbo's Bitterino. Coughs, colds, hoarseness, bronchitis, asthma, whooping cough and all diseases of the respiratory organs had not a ghost of a show in a household fortified with a few bottles of Respirato, the most magical discovery of the age, large bottles $1, small bottles 50 cents. Warts, corns, bunions and boils on ANY part of the body simply disappeared like dew before the morning sun after a few applications of a famous vegetable oil distilled from a rare plant that only flourished in a restricted area in the most inaccessible parts of the Himalaya mountains.

In later years I have stood spellbound before immense lithograph advertisements portraying scenes from the early history of the country, Columbus discovering America, LaSalle floating down the Mississippi, Pere Marquette at the mouth of the Au Sable, the Conquistadors on the old Santa Fe trail and the first covered wagon fording the Colorado. All the pictures lauded the virtues of a famous brew that now practically is only a memory, but I am free to confess that I derived more pleasure from contemplating these works than I did from a similar view of any paintings I ever have seen in any picture gallery.

It may be that my early foundry training and local environment left me with a depraved taste and the inability properly to appreciate the truly beautiful in art, but the fact remains that here I am still willing to throw a bouquet at a beer sign, and, as if to further aggravate the situation, I am not ashamed and have no apology to offer for this curious perversion.

The pamphlet I received through the mails made no mention of teaching the art of painting signs. However, I reflected that only was a detail and probably was included in the course of instruction. That was the only phase of the business in which I really was interested, or in which I had any ambition to shine. I had almost arrived at the point of asking one of my young assistants to bring me paper and a pencil to write a request for further information when Bill arrived on the scene. Before committing myself to the irretrievable I laid the proposition before him and asked his advice. "Well," said Bill, "I'll tell you. This here advertising game is one that has developed to immense proportions during recent years. At one time little advertising was required to carry on business, but gradually methods of doing business have changed and advertising in one shape or another has been responsible for the change. It occupies the curious and anamolous position of being both the cause and the effect. Advertising created business prosperity and now



LEGEND ON UPPER CORNER DELETED BY CENSOR

prosperity results in further advertising. It is like a kitten chasing its tail.

"Business methods and conditions today bear little resemblance to those in vogue at the time a famous statement was made to the effect that if a man made an article—any article—even a mousetrap, better than it was made by any other man, it did not matter if he built his home and pursued his business in the midst of a vast wilderness far from the usual habitation of men, the world would beat a pathway to his door. If any statement is repeated often enough it acquires a certain measure of respectability and authenticity and is accepted as gospel by a public that long ago has relinquished the habit of thinking for itself. In your own experience you may have noted that the feature is captalized by the modern advertizing fraternity We, the common people, and others who maybe are not so common—at least in their own estimation—we dodge anything that involves any mental effort We want and indeed have come to expect our opinions ready made. Let some person originate a saying or a fad of any kind and the public swoops down upon it, takes it to its bomo, works it to death like a child with a new toy, then cheerfully casts it aside in favor of the next trifle that promises variety. Let some person with the knack of securing publicity or notoriety, make a statement to the effect that something is so and immediately the public rises up on its collective hind legs and affirms it is so whether it is so or not. We are a queer outfit.

"Personally I have the greatest respect for the gentle, kindly and venerable citizen who is credited with coining the phrase about the mousetraps, but I think in this particular instance his wires were crossed, or, if one may be permitted to introduce a slang phrase into such a serious discussion, he was talking through his hat In strict justice it must be admitted that the phrase may have been justified in his day, but times and customs have changed and it has little application today.

"Before going too deeply into the subject and before we line ourselves up into violent partizan camps on either side of the controversy it may be well to consider that the statement first was made nearly 100 years ago and even the most rabid sympathizer must admit that some considerable volume of water has flowed under London bridge since that time.

"It is to be regretted that no reliable statistics are available on the subject, but I think I am keeping well within conservative bounds when I assume that the number of mice caught in the same time if placed end to end would form a quadruple girdle around the earth at the equator with enough material left over to run a few pendant tassels down several of the more prominent parallels of longitude. This calculation is based on the provisio that the mice are measured from the tip of the nose to the tip of the tail and not simply from end to end in the ordinarily accepted sense of the term.

NOTHING LIKE A REAL ACTUAL DEMONSTRATION

"In all probability the demand for mousetraps was more pressing and insistent—perhaps snappy would be a more appropriate term to employ in connection with the device—in those days than it is in our's. Again it is only reasonable to assume that the product crudely made by hand, could in no way compare with the classy, standardized, machine made contrivance familiar to us common people who do our shopping in the ubiquitous 5 and 10 cent stores that serve as a monument to the genius to Mr. Woolworth.

"The little wooden disk, the various wires and springs and the small circular openings around the periphery are designed for a certain purpose and require no explanation, but I for one never will rest happy until some good natured person, a master mouser if you will, tells me why this piece of household equipment invariably is painted that ghastly, peculior and impossible shade of red. Is it possible that mice like men are attracted by red?

"Another reason that might be adduced with perfect propriety in support of my objection to the famous statement is that in all probability the author was treading on unfamiliar ground when he employed the homely illustration. Viewing all the circumstances in connection with the controversy in a strictly impartial light one might feel reasonably safe in doubting his ability either in judging the proper qualifications of a mousetrap or, to use the proper technical expression, to set it.

"It is a lamentable fact that while a mousetrap is rapid, efficient and reasonably positive in action at the psychological moment or in other words at the moment of contact, still there is no getting away from the fact which may be regarded as a fundamental factor, that a certain amount of intelligent human supervision is required to bring all these desirable qualities into play. Taking all the foregoing factors into serious consideraton I think I am justified in assuming that the trade in mousetraps did not amount to any alarming volume in early New England days and therefore, the statement forms no criterion by which to judge modern conditions. I think I also am safe in assuming that you will agree that the only way to put anything across in this gross materialistic age is by systematic, persistent advertising.

"The manufacturer who erects a large illuminated sign over his front door, or over his factory; who provides a wide, straight, smooth and easily traveled path from the main thoroughfare of the world's commerce to his office, a path plentifully ornamented with large legible signs, has a fighting chance to keep his operating force busy. The man who is content to remain in seclusion, irrespective of the merit of his product, until a clamorous public beats a way to his door, eventually will be forced to creep out of the jungle that has grown up around him, through the narrow, tortuous and highly humiliating path that leads through the bankruptcy court.

"Consider the conventions and exhibitions of the American Foundrymen's association which have been held at periodic intervals over a period of 28 years and which culminated in the recent show put on at Milwaukee. It was the largest in point of attendance and the most important in many respects of any in the long list. Stripped down to its essentials it was based on the advertising idea. Primarily it was designed as an educational institution, but that is what advertising is in the last analysis, something that will educate people to appreciate equipment, methods and information that will enable them to produce intelligently and meet competition that every day is growing more keen in every section of the industrial field. The varied and extensive line of equipment shown indicated the extent to which mechanical appliances have replaced the slow and laborious hand

methods that were in vogue in previous generations. Papers read at the technical sessions and the discussions which followed served as a fair criterion of the extent to which science has replaced the old hit or miss and rule of thumb methods which characterized foundrymen of the old school. Another gratifying feature and one that perhaps was more apparent to men who have been engaged in the foundry industry for many years was the frankness which pervaded these discussions and the manner in which pioneers along many paths shared the result of their experiences.

"Interesting as the convention and exhibition were in themselves still the fact remains that the gray iron and brass foundrymen are distinctly behind their confreres in the steel and malleable iron branches of the industry in taking advantage of the benefits to be derived from intelligent, extensive and well planned advertising.

"At one time not so long ago the gray iron founder dominated the casting field. Gray iron foundries still are in the majority so far as numbers are concerned, but they have not increased numerically in proportion to the expansion of the casting industry as a whole. Steel foundries, particularly electric steel foundries and malleable iron foundries have shown a phenomenal growth in recent years and have taken over in whole or in part many complete lines that formerly were considered the exclusive perquisite of foundries pouring gray iron.

"This condition may be traced to two principal causes. The steel foundries and malleable castings manufacturers have spent large sums of money in intensive research work leading to the production of superior castings. They have followed this preliminary work up with extensive advertising campaigns designed to acquaint the casting buyers with the advantages to be derived from using their products. If the gray iron foundrymen are going to hold their own in taking care of their legitimate share of the castings requirements of this country they will have to stir themselves and develop new fields and new uses for the product of their foundries. The task is not impossible. All that is required is ingenuity, application and the courage to branch out into new fields that will involve for a time the spending of real money. It has been done by the steel men and the malleable men and surely the iron men, the oldest in the field will not fail where their younger competitors have succeeded."

"The idea sounds feasible," I said, "but how do you propose putting it into effect?"

"Well," said Bill. "I'll tell you. I have not worked out all the details, but I may turn the job over to you after you have finished that advertising course you have on your mind. Goo' night."

Studebaker Opens New Foundry

(*Concluded from Page* 893)

the castings are sandblasted on two rotary table cabinet machines, also in two sandblast tumbling barrels, one large and one small.

Cylinder and crankcase castings are loaded on roller conveyors which carry them past the various chipping stations and grinding wheels erected at convenient points between the various batteries of tumbling barrels. The smaller castings are transferred from point to point in suitable boxes mounted on trucks. Some of the castings are shipped directly from the cleaning room, but the majority are taken first to a machine shop adjoining, where they are given a roughing cut.

Seven dust arrester units have been erected in a narrow chamber between the cleaning room and the machine shop. The various pieces of cleaning equipment are provided with suction pipes and are arranged in groups so that approximately an equal number of machines is tributary to each dust arrester unit. The pipes from each machine are carried under the floor and are connected with a main pipe. The main pipe in turn discharges the material through a connection leading to the top of the dust arrester chamber.

A depressed standard gage track connected through suitable spurs with the New York Central railroad and the Pennsylvania railroad enters the building to the extent of six car lengths at the north end of the cleaning room. The floor of the building is flush with the floor of a freight car, an arrangement that greatly facilitates the use of battery trucks in loading the cars.

Present Survey Covering Eye Hazards

A new publication covering eye hazards in industrial occupations has been issued by the national committee for the prevention of blindness, an organization with headquarters at 130 E. Twenty-second street, New York. This handbook, which was prepared by Louis Resnick and Lewis H. Carris covers in a thorough and exhaustive manner, the nature and causes of eye injuries in industry, the elimination or prevention of such accidents and first aid treatments for eye injuries.

Further, diseases of the eye are explained and precautions to observe against contracting them are noted, while the conservation of vision through proper industrial lighting, periodical examination and treatment is set forth. Spoilage, errors and personal injuries have been decreased with a marked benefit to plant morale in cases where examinations are conducted and treatment to correct defective vision is provided. The book is a valuable guide for safety engineers, inspectors, safety committeemen and plant nurses and physicians.

Issue Export Handbook

Sources of information of value to exporters and importers in the solution of many of the problems involved in foreign trade are indicated in the foreign commerce handbook for 1924-1925 which has just been issued by the chamber of commerce of the United States.

The pamphlet is designed to contribute to a wider appreciation of the facilities available to American business men in the conduct of overseas trade. Sources of information and service are listed under 90 separate headings, such as acceptances, advertising, bills of lading, chartering, incorporation abroad, harbor charges, samples.

The Austin Co., Cleveland, has removed its San Francisco office to 244 Kearny street.

HUSH! DO NOT DISTURB THEM. THE DEAR CHILDRE N HAVE WEARIED OF THEIR TIRESOME OLD BOOKS

Many Types of Fillets Used

Castings Are Given Additional Strength and Patterns May Be Drawn Easier from the Sand Where Fillets Are Used—Trouble Is Encountered in Maintaining a Feather Edge on the Fillet

BY WALTER C. EWALT

FILLETS are used on patterns for two principal reasons, first because the change in the shape of the pattern produces a stronger casting and second because the patterns provided with fillets are easier to draw from the sand. The casting is strengthened due to the fact that crystals are formed in iron when the metal changes from the molten to the solid state, the crystals arranging themselves perpendicular to the surface of the casting. The heat leaves the mass of metal towards the surface and the crystals arrange themselves in a like manner.

The lines of crystals assembling in the direction of the surface are illustrated in Figs. 1, 2 and 3. In Figs. 1, and 3 the lines are almost parallel to each other and form continuous lines from one surface to the other. The lines shown in Fig. 2 form four triangles and across the diagonal lines the weakest and most porous part of the casting is found. If the crystals form a square corner, as shown in Fig. 4, it will be seen that the crystals at the corners make a poor connection. These changes in form from a regular to irregular crystallization cause a weak spot which often may be overcome by fillets and round outside corners.

The second reason for the use of fillets namely the fact that the molder may draw the pattern from the mold much easier also is important. The mold will be left cleaner if the pattern has fillets as there are no sharp corners to break away when drawing the pattern, or when the metal is poured in the mold. A filleted casting also fulfills the mechanical eye of an engineer, craftsman or designer. The appearance of a casting often determines its saleability and castings where fillets are used have a pleasing shape.

Perhaps the best kind of fillets are those which are turned or worked out by hand, or which are a part of the pattern. Examples of this type of fillet are shown in Figs. 5, 6, and 7. The fillet shown in Fig. 5 was made when turning up the pattern. Fig. 6 at *A* shows the crotch cut out with a dovetail saw and chiseled flat, after which a piece of wood was inserted and worked out as shown in *B*, Fig. 6. A rib set into the pattern is shown in Fig. 7 and at *A* are shown the fillets which were worked out with a plane or gouge. This method of construction is shown in Fig. 8, which represents square pieces glued in the corners and afterwards worked out to the proper radius.

It is exceedingly difficult to carve wood to a feather edge and the dampness of the mold soon will loosen and curl up the feather edge. If straight work is required, wood fillets may be obtained on the market which are made in the shape of an obtuse angle, as shown in Fig. 9. These fillets are more than 90 degrees, that is about 93 degrees and are made to a feather edge glued and pressed into an angle shown as shown in 9 *B*. The two pieces are at *B*, Fig. 9. The wood fillet may be put in a fillet board to make the feather edge stick and stay tight and a round piece of wood whose radius is greater than the radius of the fillet, is wrapped with sand paper and worked back and forth on the feather edges of the fillet. This rounds the edges, leaving more wood which may better stand the action of moisture than the feather edge. How this is accomplished is shown in Fig. 11, and while it is not a perfect radius, it is satisfactory for the purpose.

These fillets are made in numbers from 4 to 32 inclusive and in sizes of radii from ¼ to 2-inches inclusive. The numbers and size in inches is as follows:—

Number	4	6	8	10	12	14
Size in inches	¼	⅜	½	⅝	¾	⅞
Number	16	20	24	28	32	..
Size in inches	1	1¼	1½	1¾	2	..

A fillet made of paper is satisfactory for patterns which must be made at a lower cost or where only a few castings are required, and may be used for straight or curved work. This type of fillet come in numbers from 3 to 16 inclusive and may be put on with shellac or glue. Beeswax also is used for fillets and there also is a wax composition fillet on the market.

A satisfactory fillet is made of good leather. This type is made in the same sizes as paper fillets. It should

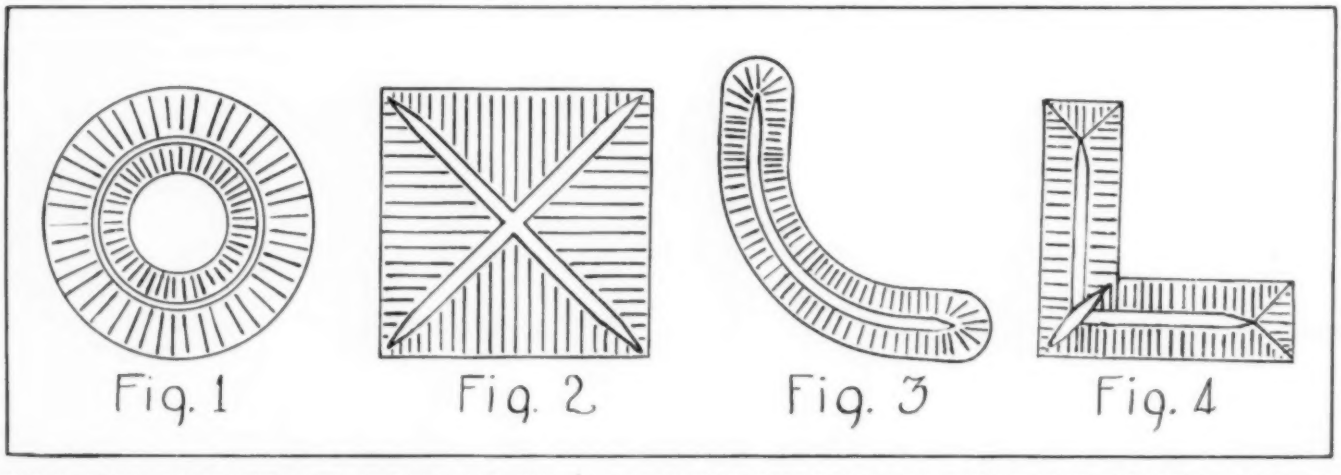


FIG. 1—LINES OF CRYSTALS IN A ROUND CASTING FIG. 2—AT THE DIAGONALS ARE FOUND THE WEAKEST PARTS OF THE CASTING FIG 3—THE LINES OF CRYSTALS ARE ALMOST PARALLEL FIG. 4—A WEAK SPOT IS FORMED WHERE A SQUARE CORNER IS MADE

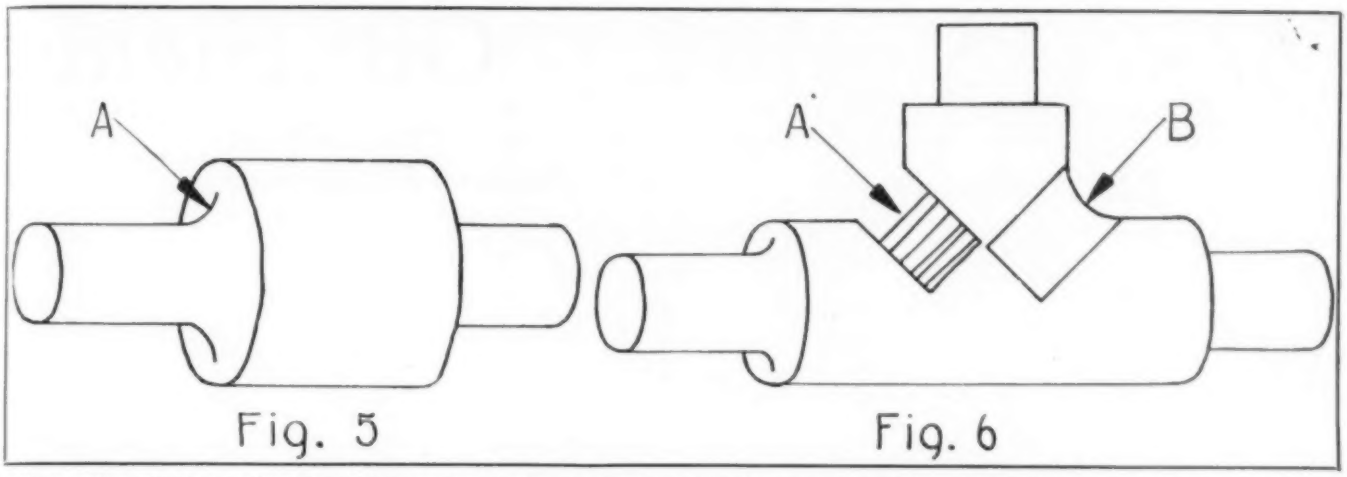


FIG. 5—THE FILLET MAY BE TURNED AS A PART OF THE PATTERN FIG. 6—A CROTCH MAY BE CUT AND A PIECE OF WOOD INSERTED AND WORKED TO THE PROPER SHAPE

be firm and pliable and cut to a feather edge, being applicable for either round or straight work. These fillets may be fastened easily with glue or shellac. The author believes that shellac is preferable to glue, since when damp glue will swell slightly, leaving a ridge as shown at Fig. 12 which interferes with drawing the pattern from the mold. The corner of the pattern and fillet should be given one or two coats of shellac and the fillet rubbed in with a fillet tool, shown in Fig. 13. The center part is rubbed with the same size ball as the radius of the fillet, and then with a slightly larger ball, the edges being pressed down firmly. Dampening the leather fillet in cold water will aid in bending it into the desired shape.

Considerable thought and study has been given to fillets in steel casting. It is the oipnion of many steel manufacturers that the fillet, often called *Dutch fillet* probably is the best, especially where a flange of considerable thickness is joined to a body which is much smaller in thickness. It is thought that a much stronger corner is made when the fillet causes the thickness of the metal of the body to attain more gradually the thickness of the flange. It will be observed in Fig. 10 that the fillet is composed of two radii which interest.

The following table should be of benefit to those wishing to make round outside corners:

	1	2	3
	37/64	1 11/64	1 49/64
5/64	41/64	1 1/4	1 53/64
9/64	47/64	1 15/16	1 29/32
7/32	51/64	1 13/32	1 32/32
9/32	7/8	1 15/32	2 3/64
23/64	61/64	1 35/64	2 1/8
7/16	1 1/32	1 5/8	2 3/16
33/64	1 3/32	1 45/64	2 17/64

Gage lines on each side of the corner or edge is taken from figures given in table. The patternmaker may work down to these lines, and then round off the remaining wood.

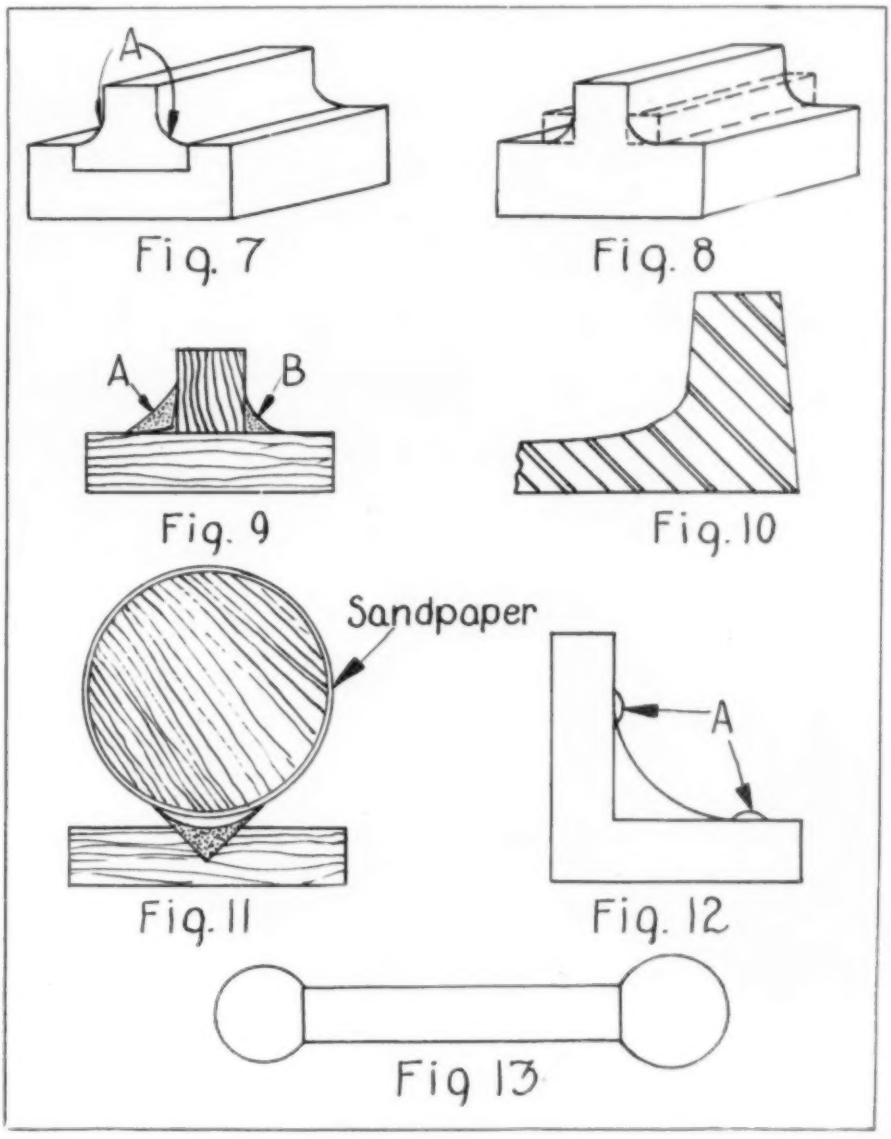


FIG. 7—THE FILLET MAY BE FORMED BY A RIB SET INTO THE PATTERN FIG. 8—SQUARE PIECES ARE GLUED IN THE CORNERS AND WORKED TO PROPER RADIUS FIG. 9—A WOOD FILLET MAY BE OBTAINED HAVING AN OBTUSE ANGLE FIG. 10—A FILLET MAY BE COMPOSED OF TWO INTERSECTING RADII FIG. 11—THIS METHOD MAY BE USED IN ROUNDING THE EDGES FIG. 12—GLUE USED TO FASTEN FILLETS MAY SWELL AND INTERFERE WITH THE DRAWING OF THE PATTERN FIG 13—A FILLET TOOL

Make Steel for Oil Fields

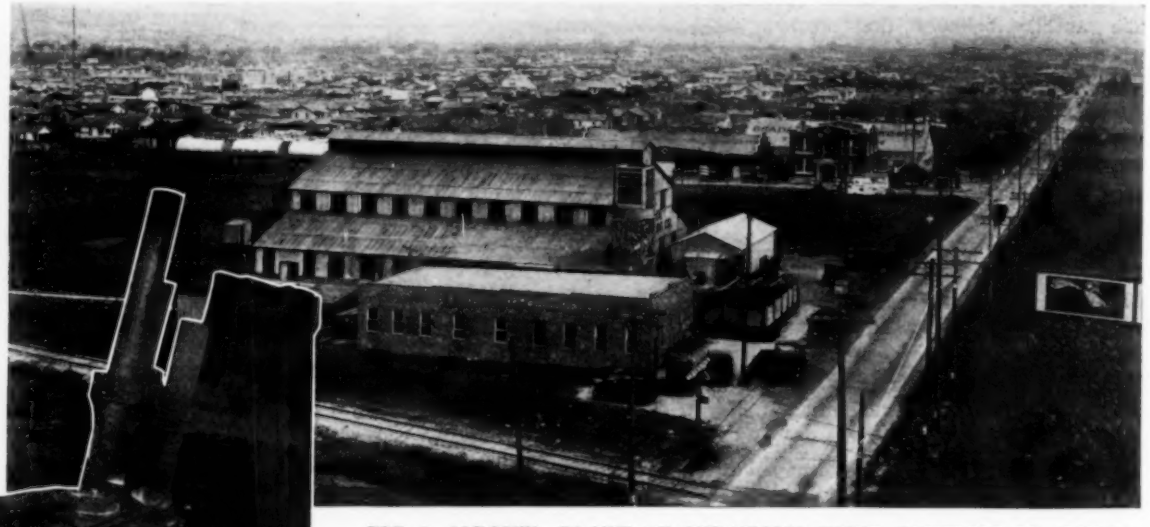
Demand from Domestic Sources Induces Oklahoma Firm To Engage in Steel Castings Manufacturing—Widely Divergent Requirements in Shapes and Properties Noted

BY DUDLEY W. MOORE

WITH its plant at Tulsa, Okla., in the heart of the Mid-Continent field, the Oklahoma Steel Castings Co. is making a specialty of electric steel castings for the oil industry. Obviously there can be no standard practice in the manufacture of steel castings for the oil country, as in the average steel foundry producing commercial castings. This is due to diversity of shapes and quantities of the castings and the widely varying analyses of the steel. Every steel casting in the oil fields has a different duty to perform and must be studied and developed to obtain the desired results. By keeping in close touch with the field men, watching the performance of each casting and studying the needs of the industry, the company has been able to manufacture steel castings that will give results and dependability in the oil field.

With special problems to solve, widely varying classes of castings and analyses of steel, production costs require special attention. To earn a fair profit on every casting is admittedly sound business. Not to charge the customer more than any casting is worth is a policy just as essential. The company's cost system is a controlling factor from raw material to finished castings.

All scrap is purchased on analysis and each car load is analyzed before unloading. The analysis is used by the melter in making up his charge and prevents the use of poor scrap. The daily heat reports show the quantity used. As each bin is emptied the quantity taken from it, as shown on the heat report, is checked against the amount purchased and any shortage or overage is found and immediately absorbed, eliminating the possibility of a heavy shortage at the end of a fiscal year. The same care and accuracy obtains throughout the system. All molding, core and cleaning labor is on piece work, eliminating any uncertainty as to direct labor. A monthly inventory of materials is taken, making it possible to know the costs from month to month by departments, or as a whole.



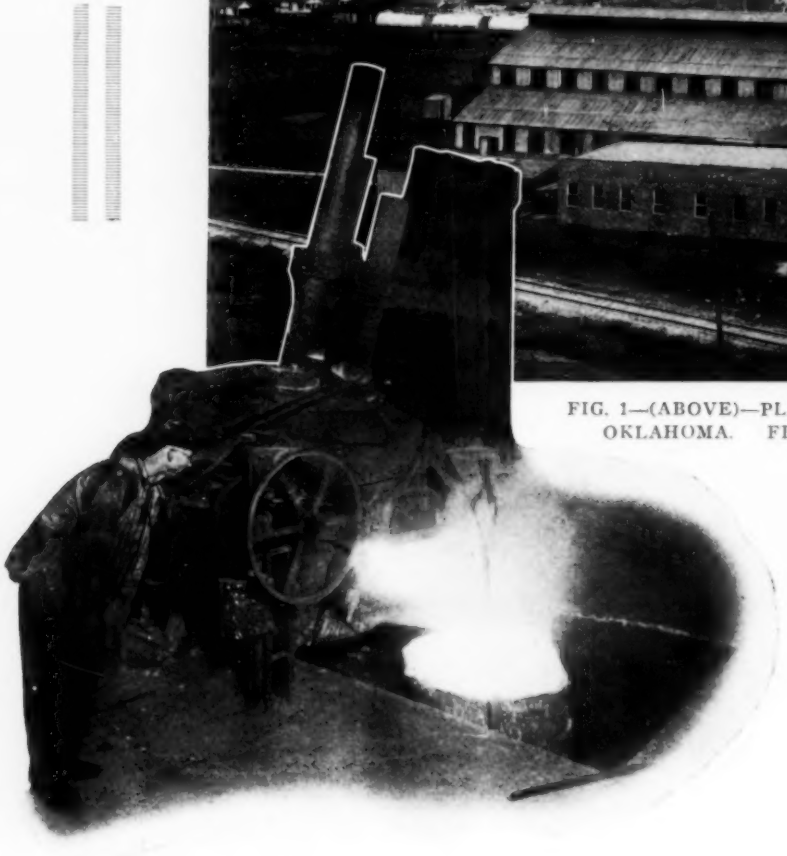


FIG. 1—(ABOVE)—PLANT OF OKLAHOMA STEEL CASTINGS CO., TULSA., OKLAHOMA. FIG. 2—(BELOW)—POURING ELECTRIC STEEL FOR OIL WELL CASTINGS

The plant was built in 1921, and has the advantage of being built as a unit and not as a succession of enlargements. The furnace equipment includes one 1½ ton furnace, with equipment for automatic control and rapid operation, using power at 13,200 volts. This equipment was supplied by the Pittsburgh Electric Furnace Corp., Pittsburgh.

In producing castings varying in weight from one-half pound to three tons, subdivision of the molding department is necessary. Large castings are molded on the main floor by hand and are handled by a 5-ton, three-motor, electric crane manufactured by the Case Crane & Engineering Co., Columbus, O. Other fairly heavy castings are

molded on jolt machines manufactured by the Tabor Mfg. Co., Philadelphia. Light castings are molded on the side floor on power squeezers. All molding sands are mixed in a sand mill manufactured by the Phillips & McLaren Co., Pittsburgh. The entire heat is tapped into a bull ladle which is removed by the crane to the center of the molding floor. Large castings in the main bay are poured from the bull ladle by the crane, while the small work on the snap floor is poured from shank ladles. Large castings are removed by the crane to the shakeout floor. This is located close to the sand mixer to eliminate lost motion in the removal of sand from the shakeout floor to the sand mixer, where all backing sands are reconditioned. The core room is opposite the snap floor. Coremakers' benches are close to the sand mixer to expedite delivery of core sand.

The core ovens are at the opposite end of the core room. The battery consists of three ovens equipped with standard trucks, designed and specially built by the company to care for the large variety of cores, which range from 1 inch to 12 feet in length. The ovens are fired by gas.

Larger castings are shaken out at the entrance to the cleaning department and loaded on sand blast trucks. If heads and gates can be removed by sledging this is done. Castings whose heads must be cut off are then taken to the oxyacetylene torches. Small castings from the side bays are delivered to the sprue cutter where heads and gates are removed. They then are taken to the sand blast. All castings are inspected at this point for defects. If slight imperfections appear they are repaired, and if defective they are scrapped before further labor is put on them. The sand blast equipment consists of a unit manufactured by the Pangborn Corp., Hagerstown, Md.

Castings with surface defects go direct to the 300-ampere arc welder, manufactured by the Lincoln Electric Co., Cleveland, after having been sand blasted, while the others go direct to the grinders. After grinding, castings are inspected for smoothness to make sure that all heads and gates are ground flush and to detect defects which may have appeared after grinding. Castings are then removed to the chipping benches. At this point the castings again are inspected to see that all cored holes are thoroughly cleaned or drifted.

FIG. 3—HEAVY MOLDING FLOOR ON WHICH VARIED TYPES OF CASTINGS ARE MADE

Inspection Before Shipment

All castings are annealed, unless the customer advises to the contrary, in a gas-fired annealing furnace. Castings then go to the tumbling mills, or if of light design they are taken to the sand blast. From the tumbling mills or the sand blast the castings are taken to the shipping floor where they receive their final inspection before final delivery.

In addition to the steel foundry, the company has built and equipped a modern pattern shop. The company is in position to make, or redesign, all classes of patterns, wood, metal, brass or aluminum. The pattern shop became necessary on account of the large variety of newly designed oil country tools and specialties and further because of the importance of having the pattern made by the same company that makes the casting, to eliminate troubles which many arise from improperly made patterns.

The company employs about 75 men and produces from 90 to 110 tons monthly. It started actual operations in August, 1922, having pioneered that territory as a steel foundry. Ernest H. Cornelius is president and general manager J. R. Johnston vice president and works manager, Verser Hicks secretary and L. C. Baston treasurer.

Notes Properties of Pearlitic Iron

BY V. DELPORT
(European Manager, The Foundry)

J E. HURST, managing director of the Centrifugal Castings Co., Ltd., Kilmarnock, Scotland, was the speaker at the first meeting of this season recently held by the London branch of the Institute of British Foundrymen at the Engineers' club. He spoke on the subject of pearlitic cast-iron.

The author said that the study of this particular cast iron originated over a year ago in Germany and mentioned an article in THE FOUNDRY, of Dec. 15, 1923. Mr. Hurst laid stress on the definition of this pearlitic cast iron, pointing out that the term should be used only for pig iron low in carbon and silicon which would solidify white under normal circumstances but which, after having been treated by the patent process of Diefenthaler, presents a pearlitic structure with graphite inclusions. Mr. Hurst suggester that the cast iron obtained by the use of that special process should be called Lantz pearlitic cast-iron. He said that to obtain this structure by the process in question, it also was necessary that the percentage of phosphorus and manganese should be low.

The process consists of bringing the mold preliminarily to a given tem-

perature. The percentage of graphite and combined carbon are given in advance. It is pointed out that the mold is to be preheated according to the thickness of the casting. When the thickness increases the preheating temperature decreases. It also is pointed out that if the percentage of silicon decreases the preheating temperature also decreases. Two other methods also have been suggested, one consisting of reheating the mold and the casting after the casting has been poured into the mold, the other of heating the metal itself at a higher temperature. Further stress was laid on the fact that cast iron of that type treated in the usual way would present a white structure.

It will be recalled that the properties of this pearlitic cast-iron are, its high tensile strength, considerable impact stresses, a comparatively low Brinnel hardness, reduced formation of pipe, resistance to abrasion and a certain ductility which permits of the replacing of malleable cast iron in certain parts by pearlitic cast iron.

Tests were made in a particular instance with a test piece 1¼ inches thick, 29 inches long, cast in dry sand, the analysis of the test bar being, total carbon 3.26 per cent, graphite 2.41 per cent, combined carbon 0.85 per cent, silicon 1.11 per cent, manganese 0.79 per cent, sulphur 0.154 per cent, phosphorus 0.40 per cent. It was found that the tensile strength was high, but the lecturer pointed out that the total carbon in the test bar was normal and that the bar normally treated would have presented a gray structure. There was a discrepancy between the analysis of this test bar and the specification indicated by the potent process of the pearlitic cast iron given by the originators of the process. These specifications are as follows: Total carbon, 2.80 to 3 per cent; graphite, 1.95 to 2.15 per cent; combined carbon, 0.75 to 0.85 per cent; silicon, 0.80 to 1 per cent; manganese, 0.70 per cent; sulphur, 0.10 per cent; phosphorus 0.40 per cent.

Mr. Hurst concluded that owing to the high tensile strength of this cast iron the process was interesting if it can be obtained in a regular manner. However, he pointed out that the special properties of the pearlitic cast iron are not in fact due to the pearlitic structure in itself since, as a rule, the lower the silicon the better resistance to wear. He also said that low silicon is favorable for resistance to distortion under heat and he pointed out the importance of the grain size and of the graphite size. Generally speaking the process demonstrates that the properties are due to the rate of cooling and the temperatures of the molds at time of pouring which is of major importance.

Production Welding on Cylinder Blocks

ACCORDING to a recent article in *Oxyacetylene Tips* one of the great automobile manufacturing plants in the Middle West has standardized the application of oxyacetylene welding in the production of cast iron parts to the point where the process has assumed a definite place as one step in the manufacture and preparation of the products of the company's gray iron foundry. This standardization includes not only the handling of the parts to be welded, their preheating, actual welding and annealing, but in addition every detail of the work even down to the oxygen and acetylene pressure permitted in the welding of certain classes of frequently encountered defects.

When welding first was introduced, a small separate space was grudgingly allotted to the process, and the work sent to the welding department was only that which could be done by no other process in use at the plant, and was of such nature that the remarking or replacement of the part would have been inconvenient or impossible. Such satisfactory results were obtained even from the application of the process in this way that the officials and executives permitted the extending of its scope of usefulness, and now are enthusiastic about the success it has met with as an operation on the main production line in the plant. The operators work in three shifts of eight hours each, and there are from one to nine or 10 men assigned to a welding division station.

Cylinder blocks are placed on the conveying system as soon as they are poured, and travel through the plant from one operation to another, finally arriving at the stores and shipping departments a completed unit, with all the component parts assembled, ready to become a part of a finished car. While in the conveying system the necessary inspections and tests are made. Defects in the castings uncovered by these inspections are repaired as the casting proceeds through the plant. Facilities for handling the repairs of the imperfect castings are available at intervals along the main production line, so that a defective casting may be reclaimed as soon as it is known to be defective.

The faulty parts are not set aside to be welded at a later time, or to be sent to a special department to be salvaged at a later date. The reclamation of the defective castings is a part of the regular production process, and is considered equally as important as any of the other major operations to which the castings are submitted along the production line.

In the foundry, every cylinder block poured is started along the conveying line. The defective block starts out in the same way, and under the same conditions as the perfect one, and travels along with it until an inspection reveals the fact that it is defective. When a block is found to be unfit for service it is shunted off the main conveying line to a subordinate conveyer running through a huge oil-heated preheating furnace.

There are about 20 blocks at a time in each of these preheating furnaces, slowly moving through. The cylinders are taken out of the furnace two or three at a time, and as this is done the same number of blocks to be preheated is placed in the other end of the furnace by means of a hydraulic plunger.

When the cylinder blocks are preheated properly they are placed before the welders by helpers who use tongs to guide the blocks along the conveyer to the platform where the welding takes place. The welding operations are short, and recurrent work correcting the same type of defects in one or two kinds of parts, has made the operators particularly proficient and rapid in their work. After the welding the cylinder blocks are started through an annealing furnace somewhat similar to the preheating furnace where they are slowly cooled, and from which they work back onto the main conveying line.

The welding stations are arranged and conducted in a highly systematic and standardized manner. The operators receive their supply of oxygen and acetylene from the floor above, where a separate force of helpers handles the gas cylinders and regulates the pressures. By means of an electric signalling system the operators on the welding floor below indicate to the man in charge of the gas supply the pressures needed for the work in hand, and an additional means is provided so the operators can give instructions about the replacing of empty cylinders.

Inspecting Is His Daily Pastime

PARTICIPATION of the armed forces of the United States in the European squabble 1914-1918 was not even faintly outlined on the cards of the most experienced seer and foreteller of what fortune has in store, when the future Maj. R. A. Bull quietly and modestly announced his arrival in the town of New Albany, Ind., in the year 1874. Older readers will remember and younger readers probably have heard that this was two years after the greatest panic that ever panicked over these United States finally had run itself out and left the country and many of the inhabitants hereof as flat as a pancake. The thoughtful reader will note here how appropriate is the comparison. Both works are derived from the same root, pan-ic and pan-cake.

The fact that the major at such a time decided to take up a permanent resident in the country may be accepted as evidence, satisfactory evidence if any is required, of the patriotic spirit based on the primal fighting instinct that in 1917 prompted him to throw his bonnet—and incidentally a good job—in the air at the first tap of the national war drum to follow the streaming folds of Old Glory into foreign lands beyond the sea.

Predestined and Full Power Equipped

With an inherited name like his it was inevitable that he should acquire a military title of distinction sooner or later. A marked scarcity of suitable wars thwarted his ambition for many years, but eventually as here-in-before noted, his patience was rewarded and as an officer in the American Expeditionary force he had the honor of serving his country on the shell swept and crimson fields of Flanders, besides several other fields perhaps just as important, but which for good and sufficient G. H. Q. reasons were not accorded the same measure of publicity.

Taking his initials in the order in which they invariably appear in his characteristic signature it is apparent, of course, that *R* stands for the once familiar phrase *Rouse mit 'em* and now that the truth may be told it is no violation of confidence to state that as an officer in the ordnance department he helped to do some nifty *Rousing* where it was needed most and in all probability where it was least appreciated. The *A* corresponds with the first of three letters that figured so prominently in every news item published in every paper in this fair land between April 1917 and November 1918 inclusive and then some.

The claim has been set forth, so far as we know without contradiction and on presumably competent authority, that if hostilities had not ceased when they did cease, to put the statement on a more statistical basis, if the war had continued another month the characters *A*, *E*, and *F* would have been worn down to the quick if not actually obliterated from every newspaper typewriter in the country. Yes SIR! Sherman said it.

Mr. Bull was serving as vice president and general manager of the Duquesne Steel Foundry Co., Pittsburgh, when the opportunity was presented of offering his services to the government. Men with his wide and comprehensive knowledge of the steel casting business were not available every day and Uncle Sam promptly gave him a commission, a uniform, a free passage to France and a conditional return ticket.

After the row was over Maj. R. A. Bull calmly presented his half of the return ticket and a few days later stepped off a gang plank in New York once more a free and independent member of the great industrial army, rarin' to go. He hurried down to Washington next day, received his honorable discharge from the army and on the following day was taking a professional solicitous look through a pair of blue glasses at the roof of a furnace melting steel in the town of Coraopolis in the sovereign state of Pennsylvania.

Major Bull received his education at Butler college and at St. Louis university where he also acquired the right to attach the letters B. A. and M. A. to his name. Starting out in the traditional American manner to make his own fortune in the world he decided to specialize in inspecting, any kind of inspecting so long as there was a pleasant salary attached to it. He spent 5 years in the service of Robert Hunt & Co., and then circulated around for 23 years in the following positions set down in chronological order: Chief inspector and foreman of pipe run, United States Cast Iron Pipe & Foundry Co., Bessemer, Ala.; chief inspector Shickle, Harrison & Howard Iron Co., East St. Louis; general foreman and later assistant to vice president and general manager, Leighton & Howard Steel Co., St. Louis; district inspector for the East St. Louis and Granite City plants of the American Steel Foundries; chief clerk to second vice president and later chief clerk to general sales agent, American Steel Foundries, St. Louis; manager order department same company, New York; assistant works manager, general superintendent and manager of production, Commonwealth Steel Co., Granite City, Ill.; vice president and general manager, Chicago Steel Co., Chicago; vice president and general manager, Duquesne Steel Foundry Co., Coraopolis, Pa.

Directs Steel Founders' Group

When a group of six electric steel foundries decided in 1921 to collaborate in the solution of problems incident to the industry, Major Bull was tendered and accepted the position of research director and to that end he established an office first in Sewickley, Pa., and later in Chicago. According to the latest available information he is keeping the steel men up on their toes trying to meet his ideals.

The major has served two terms as president of the American Foundrymen's association, 1915 and 1916. He is a past president of the St. Louis foundrymen's club and is on the executive board of the St. Louis section American Institute Mining Engineers. He is a member of the British Iron & Steel Institute, American Society for Testing Materials and the American Institute of Metals and has been a frequent and valuable contributor to the technical press.

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Wanted—A Rational Iron Test

EVERY business has its own peculiar problems and one of the most prolific causes of misunderstanding with its myriad of resultant troubles is the reluctance or inability—or perhaps both—of one class of men in attempting to visualize the problems of the other class. For example, the engineering profession as a rule cannot understand why a foundryman cannot produce an iron casting that will reproduce faithfully every characteristic shown in a test bar poured from the same ladle of iron.

They point with apparent logic to the fact that an assay of ore will indicate exactly the metallic content. A diamond drill sunk into the earth will yield a core reflecting faithfully the nature and extent of every strata of material encountered by the drill in its descent. At the various custom houses through which fermented liquor is imported a sample taken from a cask or keg is accepted without question in proof of the alcoholic content. A *hand* of tobacco selected at random from a cask in the auctioneer's warehouse forms the basis on which the customers do their bidding. From experience gained over a long period of years, buyers are convinced that the various samples submitted are exact duplicates of the goods from which they are selected.

Cast iron in the fluid state is a different commodity. A test bar at best is only a guide by which a foundryman controls his mixture. Experience over an extended period and under varying conditions is required to enable a melter to draw intelligent conclusions. For example, he knows that if iron poured into a 1-inch test bar shows a slight surface chill, the same iron poured into a casting with a 1½-inch section in a green sand mold, the iron will be dense, but not chilled. The same iron poured into a similar casting in a dry sand mold will be fairly open in texture and even porous in heavier sections. The analysis may be the same in all three cases, but the physical properties will be vastly different.

To meet operating conditions the Americans have adopted a 1¼-inch diameter round bar. The British favor a rectangular bar, 1 x 2 inches in cross section, slightly more than 3 feet long and base their conclusions on a transverse reading which indicates the weight required to break the bar. In American practice the bar is broken between 12-inch centers and in the British, between 3-foot centers. The French place their reliance on a shear test by which the strength of the material is gaged by the force required to shear a small ½-inch sample taken with a hollow drill from a suitable part of the casting.

In each case the results are only relative and the foundryman must rely on his experience and judgement to apply the knowledge to estimate the quality of iron in the casting. With continued investigation it is possible that some day a test may be developed that will be as readily applicable and as reliable as the diamond drill, but in the meantime it would seem that a campaign of education is required to show customers that a test bar is only a guide or indication from which a foundryman may draw inferences.

Trade Outlook in the Foundry Industry

WITH the national election receding into the background, a feeling of tempered optimism is encountered among foundries. The greater number expect improved demand for castings, but do not look for an immediate expansion. A number of lines already have experienced an improvement, coming as a direct result of the advance in railway orders, accelerated steel mill activity and continued building construction which promises to equal last winter's exceptional record. Practically all are agreed that the foundry industry will be on the up grade through the winter, for stocks of castings are low and business in general is looking up.

Malleable Turns Corner

According to the department of commerce, the low point of the curve of malleable castings demand was definitely passed in September, when the total of orders booked exceeded the production for the month. A comparison of 118 identical companies shows that the orders stood at 44,060 tons in September, compared with 32,014 tons in August, while the rate of production in September was 37.3 per cent and in August 32.7 per cent of capacity. Railway requirements are expected to aid malleable foundries. A new high record for freight car loadings, 1,112,345 cars which was more than 10,000 cars ahead of the previous high mark was established in the week ending Oct. 25, according to the American Railway association. Further, on Oct. 1, the class 1 railroads had 49,702 cars on order, showing an increase of 3226 over the total reported on Sept. 1. August marked the low point in the unfilled orders for locomotives. At that time the total stood at 361, while September totaled 386 and October registered another gain with its figure of 486.

Prices for Raw Materials for Foundry Use

CORRECTED TO NOV. 7

Iron		Scrap	
No. 2 Foundry, Valley	$19.00 to 19.50	Heavy melting steel, Valley	$18.00 to 18.25
No. 2 Southern, Birmingham	17.50 to 18.00	Heavy melting steel, Pitts.	19.00 to 19.50
No. 2 Foundry, Chicago	21.00	Heavy melting steel, Chicago	16.75 to 17.25
No. 2 Foundry, Philadelphia	22.26 to 22.76	Stove plate, Chicago	16.50 to 17.00
No. 2 Foundry, Buffalo	19.50 to 20.00	No. 1 cast, Chicago	19.00 to 19.50
Basic, valley	18.50 to 19.00	No. 1 cast, Philadelphia	17.50 to 18.00
Basic Buffalo	19.00	No. 1 cast, Birmingham	14.00 to 15.00
Malleable, Chicago	21.00	No. 1 cast, Buffalo	17.00 to 17.50
Malleable, Buffalo	19.50 to 20.00	Car wheels, iron, Pittsburgh	19.00 to 19.50
		Car wheels, iron, Chicago	18.00 to 18.50
Coke		Railroad malleable, Chicago	18.50 to 19.00
Connellsville foundry, coke	$4.00 to 4.60	Agricultural mal., Chicago	16.50 to 17.00
Wise county foundry, coke	4.50 to 5.00	Malleable, Buffalo	17.50 to 18.00

Pig Iron Advances

Slight advances are noted in pig iron prices in the early part of November. Further, the total production of pig iron in October which totaled 2,461,444 tons, according to statistics compiled by the *Iron Trade Review*, gave the greatest increase of any month since the upward swing started in July. The October total gave a gain of more than 400,000 tons over the previous month. The difference in the gross tonnage was 19.8 per cent. On a daily average basis, the October rate was 79,401 tons per day compared with 68,454 tons in September, giving an increase of 16 per cent. The October output of merchant iron was 598,703 tons, compared with 518,017 for September, giving an increase of 80,686 tons. The daily average production for October was 19,313 tons per day, while the rate for the previous months was 17,267 tons per day. In October, 12 furnaces were blown in and 4 blown out and of these the merchant iron making stacks showed a net gain of 4 during October. The production and consumption of coal registered another increase during September, according to the National Association of Purchasing Agents.

Domestic Needs Drop

Slight decreases are noted in the sales of sanitary enameled ware. One of the large producers reports that for the first time in a number of months, castings are being stocked. According to the department of commerce, the total orders of bathtubs in September stood at 75,795, compared to 76,221 for August, while the unfilled orders dropped from 248,844 in August to 201,180 in September. Similarly orders booked for lavatories decreased from 102,730 in August to 91,523 in September. However, the backlog of unfilled orders in practically all sanitary ware foundries is ample to support present operations. The Ohio State Foundrymen's association reports little change in the rate of operations in the foundries of that state. The actual melt stood at 54.5 per cent of capacity in September and 54.3 per cent in August, while the rate of operation was 71 per cent of normal in September, last year. Stocks of materials on hand have declined slightly since August, as have also the stocks of materials received during September. Although steel mills have been increasingly active since the first of September, roll foundries have not been burdened with orders. Mills are reported to have used their available stock of reserve rolls and to have refrained from ordering until after the election. Increased roll foundry operation is predicted. Sales of machine tools are growing, while heavy foundries report increased inquiries for castings. Stove shops in the St. Louis district note additions to unfilled orders during the past six weeks, while several of the more important plants are operating at capacity.

Brass Shop Operation

Plumbing goods shops note a slight decrease in demand, but maintain a fair rate of operation. Automobile jobbing foundries making aluminum castings and those making other nonferrous parts note a slight decline in orders, although the production of automobiles increased 2.3 per cent in September over the total for August. Demand for trucks is active. New York prices on nonferrous metals, according to the *Daily Metal Trade* of Nov. 7, follow: Casting copper, 13.21½c; electrolytic copper, 13.75c; Straits tin, 53.50c; lead, 9.00c; antimony, 12.50c; nickel, 33.00c; aluminum, No. 12 alloy, remelt, 21.50c to 22.00c. Zinc is 6.60c, E. St. Louis, Ill. Average monthly prices for nonferrous metals during September, follow:

(New York Quotations)

Copper Casting	Copper Electrolytic	Lead	Straits Tin	Antimony	98-99 Aluminum	E. St. Louis Zinc
12.882	13.165	8.386	50.578	11,401	27.00	6.328

Comings and Goings of Foundrymen

E. RONCERAY, member of the directing committee of the French Association Technique de Fonderie, has been made cheavalier of the Legion of Honor by the minister of public education. This distinction was conferred on Mr. Ronceray for his valuable work in technical education. It will be recalled that E. Ronceray was one of the principal founders and organizers of the French special school for foundry engineers which opened on Jan. 1, 1924. Mr. Roncerary was graduated from the l' Ecole d' Arts et Metiers de Chalons in 1888. He first served with the Paris-Lyon-Mediterranee railroad company and also was named professor at one of the technical schools on the outskirts of Paris. Later he served with the firm of Bonvillain and helped to establish in France the manfacture of molding machines. He was then made manager of the firm and later the present firm of Bonvillain & Ronceray was established. Mr. Ronceray is well known in foundry circles for his work on various subject relating to foundry practice. He is the author of several papers, including those that were discussed at the Rochester convention of the American Foundrymen's association in 1922 and also others which were presented to the Birmingham, England, congress and in Belgium. Mr. Ronceray was one of the founders of the Association Technique de Fonderie and has been treasurer of this organization since its institution. He has recently resigned from this post owing to his many activities. He also organized the first international congress which was held in Paris in 1923 and was active in organizing the international committee for the establishment of pig iron specifications. He has also served in many official capacities in France.

J. S. Paul recently has been made general manager for the Michigan City Foundry & Machine Co., Hinsdale, Ill.

W. R. Hans has been placed in charge of a new district sales office of the Whiting Corp., Harvey, Ill., situated at Ellicott Square building, Buffalo.

Joseph Lappin, formerly in charge of the Detroit office of the Combustion Engineering Corp., New York, has been assigned to the home office for special work.

Jesse Hart recently has resigned his position as assistant foundry foreman with the Wilson Foundry & Machine Co., Pontiac, Mich., to enter business for himself. Mr. Hart had been in the employ of the Wilson company for a period of nine years.

James Cleary formerly manager of the Philadelphia office of the Combustion Engineering Corp., New York, will take charge of the Detroit and Cleveland territories of that company with headquarters at Detroit.

T. B. H. Askin has been made sales manager for the intermountain division of the American Manganese Steel Co., Chicago Heights, Ill., with headquarters in Denver. Mr. Askin has been active for a number of years in mill operations of western mining companies and for a time was connected with the operating department of the American Manganese Steel Co.

Plan Full Program

The annual convention organized by the French Association Technique de Fonderie will be held in Paris Nov. 21, 22 and 23 at the Conservatoire National des Arts et Metiers, 292 rue Saint-Martin. A number of papers will be discussed on various subjects including the standardization of patterns, the computing of production costs, the use of special grades of pig iron, defects in castings and the scientific and experimental study of sands. A total of 25 papers has been received and more probably will be offered.

Members of the association expressed a wish that the question of the refractories used in foundry practice also should be covered.

Reports Convention

Stressing the development of sand handling methods, Pat Dwyer, engineering editor of THE FOUNDRY, Cleveland, made several interesting observations on foundry practice at the first winter meeting of the Newark Foundrymen's association, which brought visitors from New York, Brooklyn and various centers throughout northern New Jersey. Mr. Dwyer confined his remarks principally to features of the recent foundrymen's convention and exhibit in Milwaukee. While most of the newer developments were to be

A POINT OF INTEREST TO VISITING FOUNDRYMEN AT THE MILWAUKEE CONVENTION WAS THE FOUNDRY OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY CO. H. E. BROWNELL IS IN CHARGE

found in equipment designed primarily for production work, the speaker stated they had and would have in increasing degree as time goes on, their application to the smaller foundry.

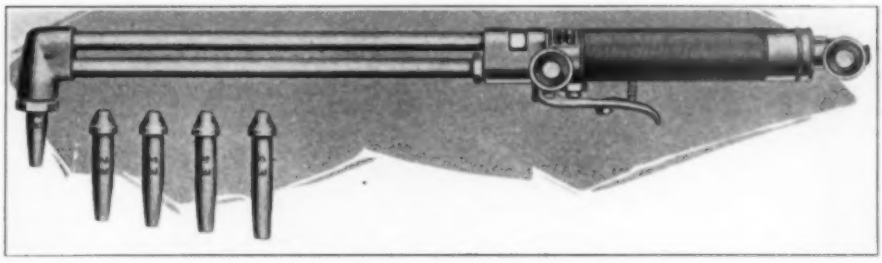
President J. L. Carter, in a few brief remarks, pointed to progress in associations apprenticeship work, and appealed strongly for the greater adoption of a uniform cost system among the association members. The association, Mr. Carter said, is planning to cooperate with the local board of education in the establishment of a night course for foundry apprentices. This course was outlined more in detail by Mr. Fuller, superintendent of the municipal manual training school.

Features Embodied in Cutting Torches

A line of cutting torches recently has been introduced by the Purox Co., Denver. These torches are designed to operate on oxygen in combination with acetylene, hydrogen or other combustible gas. The device may be adapted to welding as well as cutting by using a special welding tip.

The mixer is located at the front of the handle, remote from the heat at the tip. The front tubes may be removed easily permitting the use of special tubes of any required length and the use of 45, 60, 75 and 90 degree head angles according to the needs of the operator. The front may be removed by unscrewing two nuts, and the mixer may be changed easily in the same manner to accommodate the various fuel combinations.

The cutting oxygen lever is located on the lower side of the torch handle so that it may be operated by the first and second fingers. A latch locks the valve when depressed to any desired point and the latch releases the lever immediately when touched by the operator. The oxygen and fuel tubes in the handle are soldered into the forging at the front end of the handle.



THE TORCH MAY BE USED EITHER FOR CUTTING OR WELDING

The handle tube is a sheath and cap through which the oxygen and fuel connections are screwed with straight threads to their tubes in the handle. Hose connections to the torches are on a horizontal plane. The torches are made in two styles, the lengths being 20 and 25 inches.

Minnesota Foundrymen Attend Convention

Thirty-two members of the Twin City Foundrymen's association attended the Milwaukee convention of the American Foundrymen's association. The party left Minneapolis on the night of Oct. 11 in a special car. Considering the number of foundries in that district and the membership of the local association, the showing made was highly creditable. The association holds meetings once a month with speakers and discussions relating to the industry. The officers of the association are President, S. V. Wood; Vice President George Ashton and Secretary-Treasurer, E. H. Langdon. The members making the trip to Milwaukee included the following:

D. A. Potter, American Range & Foundry Co.; Ed. Munson and Harry Cullin, Central Machine Works; Ray Bormeau, the Commutator Co., E. L. Anderson and Peter Nelson, Crown Iron Works Co.; Charles Hope and Adam Meyer, Diamond Iron Works; Fred Quest, Menzel & Jeffery Co.; A. B. Johnson, Mereen-Johnson Machine Co.; S. V. Wood, H. K. Briggs, Ben Haller, R. A. Wood and William Kuzzler, Minneapolis Electric Steel Castings Co.; George Trust and Max Lauberbaum, Minneapolis Steel & Machinery Co.; Jack Bryant, Northern Fire Apparatus Co.; Walter Miller, N. W. Steel & Iron Co.; S. O. Abrams and Henry Fletcher, Progressive Products Co.; Fred Junger, George Zeiner and H. Berry, Western Crucible Steel Casting Co.; Fred Powers and E. A. Wassburg, St. Paul Foundry Co.; E. O. Wallace, South Park Foundry Co.; H. J. Keim and Neil Shea, Union Brass & Metal Co.; Harold Knott, Smith System Heating Co.; Ed. Moore and T. S. Harris, Minneapolis Thresher Machine Co.

Unique Drive Increases Truck Efficiency

After three years of experimental operation the Mercury Mfg. Co., Chicago, claims to have perfected an internal gear drive for industrial tractors and recently has placed a new model on the market in which this type of drive is featured. The outstanding points of interest are the balanced arrangement of the driving gears within the wheels, the method by which the gears are positioned in relation to each other, effective bearing adjustment and an oil and dust tight enclosure for the working parts.

The driving mechanism and equipment comprising the motor, motor hanger, rear axle housing, rear wheels, springs and all driving gears are assembled in a single unit which may be detached from the remainder of the frame in a few minutes. The motor joined to a pinion through a self aligning spring coupler, drives a bevel gear contained in the axle housing. This gear in turn drives the axle pinions to each rear wheel. The axle pinions transmit the power through three idler gears to a large ring gear mounted on the inner rim of the drive wheels. The motor is a series wound, high speed, automotive type with characteristics exactly fitted to the gear drive and battery assemblies. The coupling between the motor and the driving pinion comprises four coil spring.

THE TRUCK EASILY TURNS IN A SMALL CIRCLE WITH SEVERAL TRAILERS IN TOW ON THE SHIPPING PLATFORM

Election Results Are Effective

Foundry Equipment Manufacturers Note Improved Inquiry and Report Pending Action on Orders Tentative Upon Outcome of National Election—Replacements Predominate

PROBABLY in no previous national election has the business sentiment been so strongly influenced by the probable outcome. Makers of foundry equipment report numerous instances of inquiries held in abeyance and even tentative orders weighed in the balance against the result at the polls. Probably, some of these may be found incapable of producing actual contracts, but opinion is unanimous that better business is to be expected in foundry equipment lines. Inquiries extant largely are based upon extension or replacement requirements, although a few new projects are going ahead. The new plant of the Continental Gin Co., Birmingham, Ala. is under construction, supervised by the H. K. Ferguson Co., Cleveland. Equipment is being purchased directly by the Continental company. This firm recently has ordered a cupola charging machine from P. H. & F. M. Roots, Co., Connersville, Ind. Sand handling and preparation machinery is receiving more attention under impetus of the research work on sand tests. The American Brake Shoe & Foundry Co., has purchased sand mixing and conveying equipment from the Standard Sand & Machine Co., Cleveland for use in its Kansas City plant. Frederick Smith, Virginia & Truckee railway, Carson City, Nev. seeks information on equipping a small steel foundry. V. P. Magarrell, North Side Repair Shop, Tillamook, Oreg. is in the market for small capacity iron melting equipment. Crucible or small cupola furnace will serve.

Business Sentiment Outstrips Orders

WHILE not apace with the improvement in sentiment, foundry equipment buying in the eastern market has been better since the national election. One eastern Pennsylvania equipment concern had received orders for $50,000 of equipment contingent upon President Coolidge's re-election, and while this apeared to be an outstanding instance of this character, there have been a number of orders placed throughout the market that had been held up pending election results. Buying still is far from large, but the improvement has been pronounced, and is expected to continue up to the holidays, with an active resumption early next year. Business is still chiefly of a replacement character, although there is a fair amount of what may be described as additional equipment being purchased. The Bethlehem Steel Corp. is actively figuring on a substantial list for its steel casting shop at Bethlehem, Pa. It recently has purchased for this shop a 20-ton, 4-motor traveling crane, 52-foot span, from the Alliance Machine Co., Alliance, O. The Fagan Iron Works, Jersey City, is expected in the market soon for pattern shop equipment to replace that recently badly damaged by a fire, which virtually closed down the entire foundry temporarily. The United States Cast Iron Pipe & Foundry Co., New York City, has closed on two 10-ton cranes, 50-foot span, for its Birmingham, Ala., plant to the Pawling & Harnischfeger Co., Milwaukee, and is expected to inquire for equipment for its proposed centrifugal pipe shop to be erected at Burlington, N. J., and on which general contractors' bids were closed Oct. 28. Among new projects under contemplation is a foundry to be erected by the Reading Foundry Co., at Pottstown, Pa. A 140 x 180-foot site has recently been purchased. A new foundry is also said to be under contemplation by the Ellison Bronze Co., Falconer, N. Y. The Chapman Valve Co., Indian Orchard, Mass., has placed a contract with the tramrail division of the Cleveland Crane & Engineering Co. for a monorail system, with transfer bridges, while the Excel Foundries, Lebanon, N. J., has closed on five, 1-ton, handpower cranes to the Chisholm-Moore Mfg. Co., Cleveland. The Windsor Foundry Corp., Windsor, Vt., is said to be inquiring for a power shear and a 150-pound power hammer. The Glamorgan Pipe & Foundry Co., Lynchburg, Va., has purchased a cinder mill from the W. W. Sly Mfg. Co., Cleveland.

Expect Quick Pickup

WHILE several of the foundry equipment dealers in Pittsburgh and vicinity report that it is too early to realize on expectations of increased business following the election, others are firm in stating that more business is being done and more inquiries are appearing co-incident with confidence brought about by the election results. As early as Nov. 5 several telephone and telegraphic inquiries were received by manufacturers and dealers in foundry equipment in Pittsburgh, four or five telegrams being received by the Herman Pneumatic Machine Co., Zelienople, Pa., for instance, on molding machines. These originate with prominent foundries and some are for groups of machines; others for single installations. This interest has closed up numerous jobs of late involving several machines for which confirming orders have not as yet been issued. Actual orders in hand however, include three machines for the American Manganese Steel Co.'s new plant at Los Angeles, Cal., three machines for the T. H. Symington Co., Rochester, N. Y., two machines for the American Radiator Co., Kansas City, Mo., two large machines for the Richardson & Boynton Co., Dover, N. J., one large machine for the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., and one for the Pittsburgh Plate Glass Co., Creighton, Pa. This last buyer also purchased other foundry equipment, including an electric sand sifter from a prominent dealer here. Inquiries before the trade are more numerous than in many weeks, not a few resulting from leads developed at the recent Milwaukee exhibition of foundry equipment. A large inquiry for tumbling barrels from a Pittsburgh manufacturer was scheduled for closing before the fifteenth of the month. Other inquiries involve core ovens, tumbling barrels, and 10 or 12 foundries are interested in sand mixers and other miscellaneous equipment. The sale of small supplies continues in more or less spasmodic fashion, some of the foundries operating more heavily than others making more numerous replacements. Sellers report that the demand for sprayers for spraying blacking on molds, cores, etc., is particularly heavy and a few ladle driers lately have been

sold. One or two electric furnaces are scheduled for early placement. A local dealer is figuring with a new foundry at Omaha, Neb., on a complete installation of equipment needed. Dell Jolley, Samuel Holmes, and Jack Williams are interested in a foundry to be erected at Sugarcreek, near Franklin, Pa. Prices are being obtained on various classes of equipment. The Huntington Iron Works, Huntington, W. Va., will conduct improvements and extend its plant capacity, for which some equipment will be bought. A few iron and steel foundries in this territory are inquiring for grinding machines and are expected to place orders within the next week or two. Some of these are of long-standing and involve a large number of machines. While crane inquiries from foundries are scarce, occasionally one comes up and is promptly closed. The American Locomotive Co. bought a 10-ton electric crane with 96-foot span for its foundry yard at Schenectady, N. Y., from the Shaw Electric Crane Works, Muskegon, Mich., and the Continental Heater Co., Dunkirk, N. Y., bought a 5-ton crane with 50-foot span from the Northern Engineering Works, Detroit. The National Tube Co. has purchased sand blast equipment for its plant at McKeesport, Pa., from the Pangborn Corp., Hagerstown, Md.

New England Inquiry Fair

INQUIRY is steadily improving throughout New England and fairly good buying is expected before the end of the year. The E. L. LeBaron Foundry, Brockton, Mass., is in the market for a miscellaneous list of equipment including molding machines. The New England Foundry & Machine Co., Campello, Mass., has started work on a foundry addition and is about to buy molding machines, tumbling barrels, and other items. The Connecticut Foundry Co., Rocky Hill, Conn., has been inquiring for compressor and sandblast equipment. Despite this and much other less definite inquiry before the trade actual sales of the last two weeks have been about as dull as at any time during the summer. The General Electric Co., West Lynn, Mass., has purchased dust arrester equipment from the W. W. Sly Mfg. Co., Cleveland. The Eastern Malleable Iron Co., Naugatuck, Conn. has purchased sand blast equipment for its Vulcan Iron Works plant at New Britain, Conn., from the Pangborn Corp., Hagerstown, Md.

Cleveland Inquiries Increase

A NUMBER of manufacturers of foundry equipment in the Cleveland district have on hand tentative inquiries with a qualifying clause based upon the outcome of the national election. These are expected to develop into orders, although immediate action, in some cases, is not expected. Core oven builders are optimistic, as are also makers of molding machines in this district. Reported improvement in conditions in Detroit is expected to develop molding machine business. The General Fire Extinguisher Co., through the Lamson Co. which is supervising some changes and extensions in equipment of the plant at Warren, O., has placed an order with the Standard Sand & Machine Co., Cleveland for a sand mixing unit capable of handling 40 tons per hour. The Buick Motor Co., Flint, Mich., has ordered a tumbling mill from the W. W. Sly Mfg. Co., Cleveland, while the Rudy Furnace Co., Dowagiac, Mich., has purchased a cinder mill from the same interest. Inquiry for vibrators is improving, as also are orders for repair parts for this type equipment. The Ohio Brass Co., Mansfield, O., has ordered sand blast equipment from the Pangborn Corp., Hagerstown, Md.

Chicago Looks for Improvement

SOME manufacturers of foundry equipment in the Chicago district believe that with election past deferred equipment buying will be released, but a majority are of the opinion improvement will come slowly. Pig iron and coke sales indicate a steady increase in the melt, and hearten equipment interests. Sales of the Whiting Corp. include foundry equipment to the Fort Dodge Culvert & Steel Co., Fort Dodge, Ia. The Studebaker Corp., South Bend, Ind., has placed a 7½-horepower motor-driven disk grinder for its new foundry with a Chicago machinery sales house. The National Engineering Co., Chicago, has received orders for its sand mixer from the Crane Enamelware Co., Chattanooga, Tenn., and from the Chicago board of education for one for the Crane technical high school. The Allis-Chalmers Mfg. Co., Milwaukee, has purchased dust arrester equipment and the Geo. H. Smith Steel Castings Co. of that city, a sand blast unit from the Pangborn Corp., Hagerstown, Md. Core sand reclaiming machinery, with complete dust arrester, fan and piping has been purchased by the Fulton Harwood Brass Mfg. Co., South Bend, Ind., from the W. W. Sly Mfg. Co., Cleveland. The Crescent Foundry Co., St. Louis, Chicago Hardware Foundry Co. and Stewart Warner Speedometer Corp., Chicago have purchased tumbling mills and the Buck's Stove & Range Co., St. Louis has contracted for dust arresters.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Fourth Street Foundry Co., Holland, Mich., recently organized, now is operating a foundry in this city with F. S. Skellenger as manager.

American Foundry Co., Hot Springs, Ark., has completed one wing of its new foundry. *Noted Oct. 1.*

F. A. Austin Pattern Shop, 301 Wallace street, Syracuse, N. Y., was damaged by fire recently with light loss.

The Replogle Steel Co. and its subsidiary, the Warren Foundry & Machine Co., after Oct. 1 has its headquarters at room 2031, 11 Broadway, New York.

Lima Foundries Corp., Lima, O., has filed a petition in bankruptcy stating liabilities to be $62,083.13, mostly in notes and mortgages and assets of $66,586.85.

The Barnum Iron Foundry, New Haven, Conn., belonging to the estate of H. Starr Barnum, 20 Whitney street, has been sold to the Langrock Fur Co.

Phillips & Clark Stove Co., Inc., Geneva, N. Y., operator of gray iron, brass and aluminum foundries, has changed its name to Andes Range & Furnace Corp.

Quality Aluminum Casting Co., Lincoln avenue, Waukesha, Wis., operator of an aluminum foundry, is inquiring for some aluminum working machinery. A. Pankratz is manager.

Findlay Bros. Co., Ltd., Carlton Place, Ont., operator of a gray iron foundry, is inquiring for machinery and tools for pattern and model working.

The James Conroy Foundry Co., Milwaukee, has been incorporated with $36,000 capital stock, to operate a foundry and machine shop, by John M. Alphonse, J. and Robert Conroy.

The Sandusky Foundry & Machine Co., Sandusky, O., has changed its name to the Paper & Textile Machinery Co., as the latter name more clearly reflects the company's products.

Toro Mfg. Co., New York, has been organized to manufacture valves, with $100,000 capital, by T. White, S. Fein and L. J. Kreigel, with S. Shereff, 291 Broadway, as attorney.

Gisholt Machine Co., Madison, Wis., operator of a gray iron foundry and builder of machine tools, has sold its plant at Warren, Pa., to Mary S. Rapp and H. J. Onions.

Cedar Rapids Foundry & Machine Co., Inc., Cedar Rapids, Iowa, is in the market for a

used surface grinder and a punch press with at least a 2-inch stroke.

Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill., is proceeding with its action on the construction of a 1-story, 303x478-foot car foundry for which Neiler, Rich & Co., 431 South Dearborn street, Chicago, are engineers.

A complete line of wooden and metal pattern equipment, including flasks, will be manufactured by the Newark Pattern Works, 39 Avenue L., Newark, N. J., which is constructing a plant, 60x120 feet.

Sill Stove Works, Rochester, N. Y., has changed its name to the Sterling Range & Furnace Corp. The company operates a gray iron foundry and makes combination ranges and warm air furnaces.

Wayne Agricultural Works, Inc., Goldsboro, N. C., is constructing a woodworking plant and is making additions to its foundry and storage facilities. The company manufactures plows and gray iron castings. D. W. Davis is president.

Whiting Corp., Harvey, Ill., builder of cranes and foundry equipment and manufacturer of railway specialties, has moved its offices in Detroit from 3000 Grand River avenue to 650 Baltimore avenue west.

The Butler Foundry, Butler, O., has been acquired by the Federal Corp., 304 Lexington avenue, Pittsburgh, which will enlarge the newly acquired plant for the continued production of plumbing castings, brake shoes, etc.

Fremont Aluminum Castings Co., Fremont, O., is the name of the former Hotz Foundry & Mfg. Co., which is in bankruptcy. The plant and equipment of the latter company have been leased by the former from the trustee.

British Columbia Valve Co., Vancouver, B. C., has awarded contracts for constructing a plant on Terminal avenue, units to consist of machine shop, foundry, tool room, settling and plating rooms, etc. Noted Nov. 1.

Atchison, Topeka & Santa Fe railroad plans constructing car shops, round house and repair departments at Phoenix, Ariz. C. F. W. Felt, Railway Exchange building, Chicago, is chief engineer.

The United States government, superintendent of plants, navy yard, Boston, is receiving bids for the construction of a foundry at the Charlestown Navy yard there, at an estimated cost of $40,000.

Henry Donahue, 652 Van Cortland Park, Yonkers, N. Y., has awarded contracts to F. L. Whitney Co., for constructing 1-story, 72x82-foot foundry. R. Conant, Warburton avenue, is architect.

American Steel Products Co., Macomb, Ill., operator of a gray iron foundry, has awarded to Truscon Steel Products Co., 165 East Erie street, Chicago, contract for constructing 28x112-foot side addition to its plant. H. L. Gaddis, Macomb, is in charge of the construction.

Derstine Bros., Sellersville, Pa., are installing a cupola in their building being remodeled. Old forge machinery has been removed and the interior arranged for foundry purposes. The forge building and machine shop are being constructed into one building.

Aetna Machine Co., Toledo, O., has let contracts to Berkebile & Sons, 313 Broadway, that city, for constructing a 3-story, 60x83-foot brick foundry building. E. B. Abbey, 3400 Maplewood avenue, Toledo, is president of the Aetna company.

Fairfax Iron & Steel Co., Kansas City, Kans., is completing its iron and steel foundry and warehouse, the first unit of which is 140x360 feet. The company will manufacture steel, malleable and gray iron castings and railroad frogs. Walter W. Shaw is president. Noted July 1.

Frank Hamacheck Machine Co., Kewaunee, Wis., is inquiring for several pieces of equipment. The company operates a gray iron foundry. The company recently was incorporated to take over the business operating under the name of Frank Hamacheck.

Bawden Machine Co., 163 Sterling road, Toronto, Ont., will rebuild the portion of its plant recently damaged by fire and is interested in the purchase of complete equipment for same. The company operates gray iron, brass and aluminum foundries.

Chicago Bearing Metal Co., 2243 West Forty-third street, Chicago, has awarded contracts to the Austin Co., 160 North La Salle street, engineer and builder, for 1-story 66x150-foot plant. C. A. Bickett, 310 South Michigan avenue, is president of the Chicago Bearing company which operates brass and aluminum foundries.

Hoover Co., Ltd., Hamilton, Ont., subsidiary of Hoover Suction Sweeper Co., Canton, O., has prepared a building program for extensive improvements and additions to its Canadian plant for which machinery and tools will be purchased in the near future. The company operates an aluminum foundry at Hamilton.

Thatcher Furnace Co., 36 St. Francis, Newark, N. J., has awarded contracts to Wigton & Abbott Co., 552 West Twenty-third street, New York, for constructing 4-story, 49x82-foot brick and concrete warehouse and foundry building. M. Wayne, 41 St. Francis street, is treasurer of the Thatcher company which operates a gray iron foundry.

Wood and metal patterns will be the products manufactured by the recently incorporated Emerson Co., 8 Peck Slip, New York. The company will specialize in molds for radio horns and other equipment. William Emerson Jr., is president, Richard Allen, vice president and Julius Sebo, secretary and treasurer.

M. Blassberg, Turners Falls, Mass., operator of the M. Blassberg Brass Foundry, that city, has sold his foundry business to Alfred S. Rolfe, Lundenberg, Mass. The sale includes buildings and equipment on Avenue A. The business will be conducted as the Turners Falls Brass Foundry Co. Brass castings will be produced.

Sticht Architectural Iron & Bronze Works, Ltd., will establish a plant in Montreal, Que., for the manufacture of grills, stairs, railings, castings, etc., and is in the market for complete equipment and tools for that purpose. S. F. Foster, 101 Belgrave avenue, Montreal, is secretary.

Buckeye Steel Casting Co., Columbus, O., has put into operation a new normalizing furnace of the refractory tile recuperative type. It has a capacity of 180 tons of castings per 24 hours. Chapman-Stein Co., Mt. Vernon, O., was designer of the furnace which now is using oil but also is equipped for gas.

A foundry, 80x260 feet, is being constructed at Sugarcreek, near the Estergreen place, Franklin, Pa., with a siding on the Erie railroad. The building will be equipped with modern machinery and used as a foundry for gray iron castings. Dell Jolley, Samuel Holmes and Jack Williams are reported to head the company, which as yet has not been named.

Chicago Faucet Co., 2712 North Crawford street, Chicago, has retained Wolf, Ston, Harper & Trueax, 7 West Madison street, that city, as architects for 2-story, 55x65-foot plant of brick, stone and reinforced concrete, to be built at 2700 North Crawford street. E. C. Brown is president of the Chicago Faucet Co. The company operates a brass foundry.

[illegible]y Brass Foundry Co., successor to the Triumph Brass Foundry, Oakley, Cincinnati, has taken over the brass foundry department of the Triumph Electric Co., that city. No additional building or equipment is planned. The Triumph Brass Foundry was the Cincinnati branch of the Dayton Bronze Bearing Co., Dayton, O.

New Trade Publications

SPADER—A compressed air spader or pneumatic clay digging tool is described in a pamphlet of the Sullivan Machinery Co., Chicago.

GRINDER—An electric swing grinder is described in a publication of the Pneulec Machine Co., Ltd., Smethwich, England. Illustrations show the grinder being used to clean castings.

CUPOLAS—A folder published by the Whiting Corp., Harvey, Ill., gives information on the cupolas of its manufacture as well as charging machines, a helical-worm ladle gearing, cranes, hoists, tumbling barrels, etc. The folder is illustrated.

HOISTS—A motor driven chain hoist is described in a recent folder of the Motor-block Corp., Philadelphia. The details of construction and some of the features in its application are given. Illustrations show actual installations.

PAINT—The New Jersey Zinc Co., New York, has issued a 15-page booklet describing one of its special paints used for exteriors. The publication is illustrated with reproductions of photographs of buildings, etc., painted with this paint.

CORE BINDER—Information regarding the use of a core binder and facing flour covering a variety of practices, namely steel casting, gray iron, malleable iron, brass and aluminum, is included in a 12-page booklet published by the Knefler-Bates Mfg. Co., Indianapolis. Examples of proper mixtures are given.

CONVEYING EQUIPMENT—In catalog No. 1, the Standard Conveyor Co., North St. Paul, Minn., has described its roller conveyor equipment. Reproductions of photographs show installations of the equipment in various industrial plants, while sketches show the various types of equipment.

ELECTRIC SOLENOID BRAKE—An electric solenoid brake designed especially for crane service is described in a pamphlet recently issued by the Whiting Corp., Harvey, Ill. Sketches show two types of brakes, one designed for alternating current and the other for direct current. A foot brake for crane service also is described and illustrated.

INDUSTRIAL HAULAGE EQUIPMENT—The Clark Tructractor Co., Buchanan, Mich., has issued a 32-page booklet describing various types of equipment used to transport materials in industrial establishments. The equipment described includes trucks and tractors, an elevating platform industrial lift truck, tote boxes, a gasoline powered tractor truck and crane, and special trucks. The publication is well illustrated.

BELT CONVEYORS—Belt conveyors are described in a catalog published by the Brown Hoisting Co., Cleveland. The booklet presents descriptive information of the conveyor features and give sufficient general data on conveyor practice to enable the prospective purchaser to select the type of installation to meet his requirements. The latter section of the catalog is devoted to standardized belt conveyors.